Mobilization of the Electrical Industry—*Statistical Survey of Street Lighting Conditions and other Articles Dealing with Recent Progress in the Installation and Operation of City Lighting Systems*

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Electrical World

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The Greater Electrical Industry

OPPORTUNITY is written in no larger letters than in the electrical industry. It has become easy to say that the industry has been woven into the whole fabric of our national life. Phrase-making is interesting, but when a broad census of the industry is taken the facts themselves supply convincing proof for the most ardent phrase-maker. The statistics presented in the article published in this issue on "The Mobilization of the Electrical Industry," have been gathered from many sources. In some cases exact figures could be obtained. In others it was necessary to secure estimates of totals from men well qualified to guess accurately. In all instances the estimated totals represent a conservative viewpoint, and any individual disagreement with the totals would probably be in favor of even larger figures. This peaceful mobilization of the industry has many significant aspects. President Wagner of the National Electric Light Association and Howard E. Coffin, chairman of the Committee of the Naval Consulting Board, call attention to two. The figures may be interpreted by any group—engineers, manufacturers, central stations or the electrical trade. No scientist or engineer can look upon the figures without feeling the satisfaction that comes from seeing the wide-spreading branches of an industry that has its roots in the scientific and technical. Electrical manufacturers, who think of their markets as this one group or that one group, will discover new relations between buyers' and recommenders' products. Men in the electrical trade—jobbers, dealers and contractors—can measure their relation to the industry as a whole in new terms, and appreciate the significance of a trade movement, such as America's Electrical Week, which focusses the attention of the industry on the opportunities for getting more business. The electrical industry has been written in capitals before. The figures indicate that the Greater Electrical Industry is not a phrase but a fact of significance to every man in it.

An Unparalleled Act

THAT the New York Edison Company rate case is to be reopened surprises students of regulation. Generally it was believed that the 1915 order of the Public Service Commission of the First District had settled the issue for three years. In fact, that order plainly states that the maximum rate shall be 8 cents per kilowatt-hour "for a period of three years." But the mandate which the commission issued at that time "shall continue in force," it is stated, "until changed or abrogated." Therefore, in one paragraph the commission appears to have stipulated a rate for a fixed period, while in another it holds out the possibility of change or abrogation. Either the commission intended to make a rate binding for three years upon both it and the companies, or it intended to leave the case still open. If it meant to enter into a three-year agreement, why did it insert the clause referring to change? If the purpose was to leave the case still an open issue, why should the impression of a three-year settlement be given? It is our understanding that the commission which passed the order believed that it was settling the problem for three years. Now, however, a commission which contains no member of the old body holds that it has the legal right to reopen the case. Whether it has the moral right to do so is another question which, so far as is known, has not been raised. Even its legal right so to do is apparently in doubt. If the commission, without regard to its personnel at the time, made a moral contract that rates should be undisturbed for three years, that contract ought to be met in all its essentials by both parties. For either party to weaken the contract is a violation of the fair principles underlying regulation.

Public Lighting on a Cost Basis

ELSEWHERE in this issue is described an interesting form of street lighting contract which has been applied in a number of instances in Wisconsin, and made possible by an amendment to the Wisconsin statutes of last year. The fundamental purpose of the new contract, the promising features of it which have already been advocated in these columns, seems to be the establishment of a price proportional to the legitimate cost of service, about which no secret is made, together with suitable provision for the risks contingent upon the termination or modification of the contract, which, in its length, may be indeterminate. In the ordinary regulation of prices as between city and supply company, there has been little if any understanding regarding what shall be done when apparent improvements in the art come along which render the old methods obsolete, or so far from representing the best practice as to require modification. In many current contracts a somewhat indefinite provision is made for this possibility by a clause under which, in case of the introduction of improved illuminants, a change shall be made under some specified modification of price or one set by arbitration under the new conditions. Frequently an arbitrated price would have to take all the depreciation due to the change in the art which renders the earlier equipment undesirable.

The sense of the form of contract here suggested is

that the price to the city should be determined by the costs of service reckoned in a specified way, with the city furnishing assurance against the losses due to obsolescence by an agreement that it may take over the plant at any time only by paying the difference between the initial and depreciated values at that particular period. In case of change in illuminants the variation in investments and operating cost can be readily taken care of by the general method of figuring the operating expense. The scheme is worth studying in detail, because it has the advantage of putting the whole matter on a most explicit business basis. It gives the operating companies security against loss from unnecessary changes in method. Again, it provides in a perfectly definite way for the added expense of underground service, which is always perceptible and sometimes serious. For the city it gives assurance of an entirely definite cost under any given set of conditions, and provides also for one factor too seldom considered in a street lighting contract, namely, the lessened costs resulting from increasing density of service. If the number of lamps in a given territory be doubled both fixed charges and the operating expenses diminish. Under the ordinary form of contract the city which thus improves its lighting gets no benefit from it, while with the form of contract under consideration it is a perfectly easy matter to make a periodical readjustment of these matters to the benefit of both parties. For these reasons the agreement seems to furnish a suitable basis for an equitable arrangement between municipalities and operating companies, giving rather small opportunity for misunderstanding and plenty of flexibility for the successful meeting of new conditions. We shall await with interest the results of the experience to be gained in Wisconsin from the application of so promising general principles.

The Trend of Interior Lighting

AT the present time tendencies in the lighting of interiors are still in a somewhat formative condition. This class of lighting has been profoundly modified by the improvements in incandescent lamps and the practical disappearance of the arc lamp. Perhaps the greatest needs at present are to be found in the evolution of suitable fixtures that shall stand as the embodiment of modern artistic conceptions in illumination rather than being merely the hand-me-downs of a period when candles and oil lamps were the only agents upon which humanity depended for light. To pass thus from ideas derived wholly from flame illuminants of modest candlepower to those which belong essentially to our present powerful and efficient sources is no easy matter. It will take the combined skill of the artist and engineer to bring out a wholly harmonious and satisfactory result. Perhaps the main point worthy of consideration is the possibility that lies in the judicious use of color now that we at last have available units efficient enough to permit of sacrificing theoretical efficiency somewhat for beauty and effect.

For outdoor work Mr. Ryan's description in this issue of the new San Francisco lighting is full of suggestions. Some of these may be just as well applied to interior illumination. When one is using in a large interior gas-filled lamps of high efficiency he can well afford to sacrifice 25 per cent of the light if he is thereby enabled to utilize the remainder so as to enhance beauty and harmony in the resulting illumination. When illuminating engineering first took on concrete existence, hardly more than a decade ago, the situation was such that it had from the very start to fight inefficiency and manifold sins against the human eye. To-day even the uninstructed instinctively appreciate the fact that a lamp which glares full in the face is unpleasant, and realize fully the value of proper diffusion and distribution. The long campaign of education has not been without its results. To-day it is the duty of the illuminating engineer to go a step further, since efficiency has been already won by improvements in the sources of light. A far wider field now lies before him on which the sod has scarcely yet been broken. It is high time that he should avail himself of his opportunities.

Pocket Wireless Outfits

AMONG the lesser horrors attributed to the great war must be included the publicity given to pseudo-inventors whose products may be imagined to have possible military application. Doubtless many of the devices worked out by these untrained inventors are in some degree applicable to the services for which they were intended. News of the few which possess startling merit ultimately reaches the ears of the various imperial commissions or other bodies which have the power and the desire to investigate and utilize the inventions. But the wheat of valuable plans is so nearly smothered by numbers of chafflike schemes that the true worth of the better ideas is likely to be overlooked. This is all the more probable because astounding claims, even though untrue, tend to overshadow conservative statements of demonstrated fact.

In the past few years a dozen or two "inventors" have put together compact receivers for wireless telegraphy, shown that by their use they could receive messages from powerful stations at moderate distances, and then announced loudly that they had produced "new" wireless systems which completely eliminated tall ærial structures, bulky instruments and whatnot! The absurdity of such contentions as based upon any such performance is only too evident to the technical man; to the lay mind, however, there appears always to be something particularly appealing in the alleged solution of a great problem by an inventor who has attended only the "school of experience." It seems unnecessary that the curriculum there pursued by him should have been either effective or extensive!

Truly, the sensitive and selective wireless receiver which is small and light enough to be easily portable has many uses, not the least important of which are on the field of battle. Similarly, reception of messages

from considerable distances by the use of ground wires and without tall ærial masts is often advantageous. Both of these possibilities are made use of in practical radio-telegraphy, and have been utilized for many years. The production of vigorous radiated waves from low antenna wires, and the design of powerful transmitting apparatus of so little bulk and weight that it is not hard to transport, however, are vastly different problems. The difficulties of producing the ideal aeroplane motor are combined with those of leading large currents through slight conductors and of restraining high voltages with flimsy insulation. Our earnest reporters of the daily press would do well to scrutinize the claims of new inventors without losing sight of the conservation of energy.

A New Note in Street Lighting

THE description by Walter D'Arcy Ryan of the ornamental lighting system now being installed in San Francisco should be studied with attention by everyone who is interested in civic improvements. "White Way" lighting has been rather a fad for several years, and many examples of it have been installed, some admirable and others altogether garish and bad. The San Francisco program for ornamental lighting varies somewhat radically from all which have preceded it, and in directions which, from the artistic standpoint, deserve commendation. Three things are conspicuous in the new installation. First, the color tone is a golden glow instead of the somewhat hard white usually found. Second, free use is made of arcs in groups upon standards instead of single units, placed so much higher than the usual boulevard lamps as to give far less glare and an admirable distribution of illumination. Third, street railway poles have been freely utilized, thus lessening the number of standards in the streets, and giving decorative value to the supports of the trolley wire. For the most part the lamps utilized are the 6.6 luminous arcs which were used with such admirable effect in lighting the Panama-Pacific International Exposition. These units are upon the whole possibly the most satisfactory as regards power and efficiency in use in this country, and their light-giving value is so high that the colored globes can be well afforded in the interest of artistic results.

The street railway poles under the new scheme are equipped with tops for three lamps designed by some of the artists whose work was so conspicuous at the Panama-Pacific International Exposition. The poles are given a verde-antique finish, which is particularly well suited to the golden color of the globes, so that the general effect should be admirable both by day and by night. The color produced by using the luminous arc with the new glassware is a mellow whitish tone, much nearer white than that of the ordinary incandescents or the yellow flame arcs and yet quite distinct from the rather hard brilliancy of the usual white globes. Elsewhere in the city special three-lamp standards are in use with similar equipment, and in certain places special three-lamp standards are employed, carrying one arc and two 200-watt tungsten lamps with special globes matching the tone of the arc light better than would be feasible under ordinary circumstances. This combination of arcs and incandescents has been frequent in foreign cities, but is very rare in this country.

In a part of the downtown business district, in which the lighting will be completed presently, another admirable change has been made. The lamps now installed are the very ordinary clusters of incandescents. The new standards will be quite similar to those already noted, except that they carry one luminous arc in its mellow-toned globe and also two 100-watt gas-filled lamps, again in globes of golden hue. It is worth mentioning that the standards here as elsewhere are higher than have been ordinarily used for ornamental lighting, 18.5 ft. over all, while the three arc clusters are carried to the height of about 32 ft.

In the civic center the same general system of lighting is carried out, but with five-lamp standards, 37 ft. over all, fitted again with the golden globes. It is noteworthy that it has not yet been decided whether the 6.6 amp. magnetite arcs will be used here or 1500-cp. incandescents, showing how closely the big and efficient modern incandescents are pushing even the most powerful of standard arcs. Altogether the San Francisco program of improved lighting is the most novel and striking that has come to our notice, and should be carefully studied by all civic authorities who are considering the installation of lighting systems to beautify as well as to illuminate public places.

The Coming Issues

NEXT week's ELECTRICAL WORLD will be the station-operating number for September, and among the leading articles planned for that issue are several of particular interest to the engineer as well as to the operating executive. "Graphical Analyses of Engineering Problems" is the topic of a contribution by E. D. Dreyfus, pointing out instances where curves and diagrams prove of great practical value in the interpretation of plant investment, operating costs, and revenue. Methods of eliminating telephone troubles due to the presence of transmission lines are outlined in a practical discussion by E P. Peck, superintendent of the department of tests of the Georgia Railway & Power Company, scheduled for the same number. The arrangements used by the Georgia company for protecting telephones and operators when using instruments on telephone circuits carried on transmission-line structures will also be described. The following week's ELECTRICAL WORLD will be the engineering issue for the month, and under date of Sept. 23 will appear the number devoted broadly to the larger commercial topics of interest to central station managers, manufacturers, executives and electrical business men. The third issue of ELECTRICAL MERCHANDISING, the new monthly magazine which extends to the electrical trade the editorial service of the ELECTRICAL WORLD, will be published on Sept. 15.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

PACIFIC COAST CONVENTIONS

Annual Meetings of Central Station Men and A.I.E.E. to Be Held Next Week in Seattle

Both the Northwest Electric Light & Power Association and the American Institute of Electrical Engineers will hold conventions in Seattle, Wash., next week. Institute meetings will start on Tuesday and the central station meetings on Wednesday, both conventions to last through Saturday. The technical program of the institute convention appeared in the ELECTRICAL WORLD for Aug. 12 on page 309. Following is the program as arranged by the Northwest association:

Wednesday, morning session—Address of welcome by Mayor Hiram C. Gill, to which President E. G. Robinson will respond; reading of financial report and committee report. Afternoon session — "Application of Overhead Line Construction Rules of the Public Service Commissions of the Northwest," by M. T. Crawford, Puget Sound Traction, Light & Power Company, Seattle; "Adequate Protection Against the Risks of Obsolescence and Inadequacy," by Leslie Craven.

Thursday, morning session—"The Employee as an Educator of the Public," by Arthur Gunn, president Wenatchee Valley Gas & Electric Company; report of public policy committee by Norwood Brockett; "Merchandising and Operating in Small Towns and Rural Communities," by Lewis A. McArthur of the Pacific Power & Light Company, Portland, Ore., and W. F. Farquhar of the Washington Water Power Company of Spokane, Wash. Afternoon session—Report of electric range committee by W. R. Putnam, Salt Lake City, chairman. Special features of the report will be discussed as follows: Advertising, H. J. Gille, Seattle; rates, M. C. Osborn, Spokane; merchandising, J. F. Derge and S. M. Kennedy, Los Angeles; water heating, S. V. Walton, San Francisco, and A. C. McMicken, Portland.

Friday, morning session—Round table conference to be conducted by E. G. Robinson, president of the association. This conference covers three major classifications, and pamphlets containing the questions under each classification have been printed and distributed. The discussion under the different classifications will be conducted as follows: Commercial, M. C. Osborn, Spokane; legal, N. W. Brockett, Seattle; operation, L. T. Merwin, Portland, and M. T. Crawford, Seattle; J. B. Fisken, Spokane; J. C. Martin, Portland, and Arthur Gunn, Wenatchee. Afternoon session—"A Greater Jovianism," by Arthur H. Halloran, editor *Journal of Electricity, Power and Gas,* San Francisco, Cal.; "Standardization," by M. D. Cooper, engineering department National Lamp Works, General Electric Company, Cleveland, Ohio; executive session and election of officers.

ENTERTAINMENT FEATURES

A joint entertainment program has been arranged for both conventions. On Thursday afternoon an automobile ride will be provided for the ladies, covering some of the boulevards. Thursday evening a special lecture at the Metropolitan Theater will be given by W. D'A. Ryan, chief illuminating engineer General Electric Company, on the illumination of the Panama-Pacific International Exposition. This lecture will be preceded with an address by Dr. Henry Suzzalo, president of the University of Washington, on the subject of "The Engineer and the Public."

The annual banquet will be held on Friday evening at the Rathskeller, New Washington Hotel, and a theater party for the visiting ladies will be given at the Orpheum Theater. Saturday will be devoted to a trip around Lake Washington on the steamer Fortuna, leaving Leschi Park in the morning and arriving at Fortuna Park about noon, where box lunch will be provided, after which field sports and dancing will be enjoyed.

Entertainment Features of I. E. S. Convention

A feature of the convention of the Illuminating Engineering Society, to be held in Philadelphia on Sept. 18-20, will be the entertainment arranged for the delegates and visitors. On Monday luncheon will be served to visiting ladies at a suburban country club following an automobile tour through the parkways of the city. In the evening following a reception to Dr. C. P. Steinmetz will be held a piano recital and dance.

On Tuesday afternoon an automobile trip for the visiting ladies has been scheduled through suburban Philadelphia to Valley Forge National Park. Dinner will be served at the Washington Inn, Valley Forge. The tenth annual banquet of the society will be held on Tuesday evening in the Rose Garden of the Bellevue-Stratford.

Ontario Commission to Spend $1,300,000

The Ontario Hydro-Electric Commission is spending $1,300,000 to give Toronto and other Canadian cities an ample supply of electric energy. A block of 25,000 hp. has been cut off the amount of exported energy, and this block has been diverted to Ontario consumers. The commission has decided to double its plants in Toronto and Dundas, Ont., and to duplicate the transmission line from Dundas to Toronto. Plans and specifications have been completed and the purchase of the right-of-way is now being proceeded with. The Niagara Falls, Ont., station is being increased to handle an additional 50,000 hp. from the Canadian-Niagara Power Company. A second block of 12,500 hp. was taken over from this company a week ago. The maximum load is now between 115,000 and 120,000 hp. Sir Adam Beck expects that the Niagara district will use between 140,000 and 150,000 hp. before Jan. 1, 1917.

Another important announcement made by the commission is that it has decided to link up power development plants at Eugenia Falls, Big Chute, Wasdells and Swift Current, Ont. This will necessitate the construction of 41 miles of transmission line, and will make available for the whole district of Collingwood, Barrie Beaverton and Owen Sound the 4000 hp. now being generated at the Big Chute in excess of the requirements of Owen Sound, which it serves, and the 1000 hp. excess from Wasdells over the requirements of Orillia. In addition to this the northern development line would be only 6 miles from the Niagara power transmission line at Mount Forest, Ont. Sir Adam Beck has no doubt that the two systems will ultimately be connected. Work

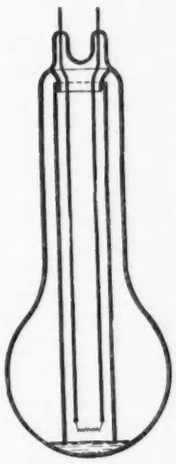
on the northern scheme will be started immediately. The commission had hoped that extensions could be postponed until normal prices for copper, aluminum and other materials had returned, and until the labor market was more settled, but this, however, was found impossible in face of the unexpectedly rapid growth of the demand for hydro-power.

Regarding recent trouble along Niagara transmission lines, Sir Adam Beck said the commission has investigated complaints and has come to the conclusion that lightning was responsible.

A Super-Efficiency Carbon-Filament Lamp

The Siemens & Halske Company of Berlin, Germany, has had assigned to it a patent, No. 1,194,643, which discloses a gas-filled carbon-filament lamp with mercury stated to have a watt-consumption actually less than the metal filament lamps. The inventors are Hans Kreusler, Hans Gerdien and Marcello von Pirani of Berlin.

It is well known that the metal filaments in lamps operating at extra high temperature are much softer than carbon filaments, so that care has to be taken in arranging the several parts of the metal filament not too closely to each other for obtaining the most favorable effect. If, however, carbon filaments are to be similarly employed they can be so disposed that comparatively large and "concentrated" helices are formed. In addition to this, much shorter or essentially thicker and stronger filaments may be used so that much more freedom is given in the arrangement of the filament as well as in choosing voltages and candlepowers. With carbon filaments it should, therefore, be possible to make lamps for small candlepowers at the ordinary voltages in spite of a comparatively high current load.



INCANDESCENT LAMP

The bulb, according to the invention, is preferably filled at the start with an indifferent gas such as nitrogen or argon under a certain pressure, about atmospheric. As soon as the current flows through the incandescent filament, mercury vapor forms in the interior chamber, due to the introduction of mercury together with the gas. The original gas will be pushed entirely or partly away from the interior chamber toward the exterior space of the bulb and the pressure increased. As the pressure on either side of the glass envelop used is the same, the latter may be heated up to a very high temperature without danger of explosion. The outer wall of the bulb will remain relatively cool, and, by reason of this, will be able safely to withstand the comparatively high pressure above atmospheric. The envelop may consist of a tube which at its lower end is closed up by means of mercury and is separated from the remaining part of the bulb.

In this lamp construction, the incandescent body is placed relatively close to the exterior wall of the bulb, but due to the presence of the mercury between the wall of the bulb and the incandescent body the exterior wall can never assume too high a temperature. In the form shown above mercury is placed at the bottom of the bulb and provides a closure at the under part of the envelop between the space of the envelop and that of the glass bulb. In this construction the conductors are prolonged downward for the purpose of having the filament near the surface of the mercury.

Niagara Falls Flood-Lighted

Paul A. Schoellkopf, member of the Niagara Reservation Commission and chairman of the Niagara Falls (N. Y.) Citizens' Committee, which was instrumental in bringing about the permanent illumination of Niagara Falls, pressed the button that illuminated the American Falls and rapids above the cataract on the night of Aug. 26. Simple ceremonies accompanied the turning on of the lights.

A considerably smaller flood-lighting system has been in effect for the past month, and the demonstration proved such a great success that a permanent illumination was decided upon by the Niagara Falls Citizens' Committee. The city appropriated $25,000 to flood-light the cataract and rapids. It had originally planned the purchase of the large reflectors used at the Panama-Pacific exposition, but these were sold to the Russian government.

NIAGARA FALLS UNDER FLOOD LIGHT

Five batteries and a total of 100 lamps are used in the lighting scheme, known as the Western-Davis system. Battery No. 1 is at the mainland end of the Green Island bridge and lights the rapids for a mile or more above the bridge. Battery No. 2 is at the opposite side of the bridge on the down-stream side and illuminates the rapids between the bridge and the cataract. Battery No. 3 is beneath Prospect Point, and throws its light on the American Falls. There are twenty lamps in battery No. 4, also on the lower river bank. Battery No. 5, the most powerful of the series, is on Luna Point, and the thirty lamps in this reflector throw their rays downward on the American and Luna Falls. Efforts are now being made to induce officials of Niagara Falls, Ont., to flood-light the Canadian Falls and the Horseshoe Falls.

MILWAUKEE PLACES ORDER FOR STEEL ARMORED CABLE

Nature of Specifications and Contracts for Street Lighting Conductors Reflect Condition of Market—Prices Increase with Length of Delivery and Quality

The specifications, contracts and prices involved in the purchase by the city of Milwaukee of 1,000,000 ft. of steel-taped cable for the new street lighting system, give a most vivid picture of the difficulties confronting the purchaser and the manufacturer in securing materials at this time. Not only was the average price paid 53 per cent higher than the cost of the same cable for the demonstration circuit in the fall of 1915, but it was necessary for the city to contract with four different manufacturers for practically all that could be secured from each, in order to complete its requirements. The manufacturers are unable to make deliveries, principally on account of their inability to get the steel for armoring the cables, of which two wrappings are required by the Milwaukee specifications, and in at least one instance there are machines standing idle with a factory full of orders waiting for steel.

Having in mind the conditions of the market, the consulting engineer for the city made out the specifications for quantities and deliveries of cable in a way to give many manufacturers a chance to bid on the order. Had the specifications been issued in the usual way for the total quantity, it was felt there probably would not have been a single bid on them, and as it was, bids were received from only five manufacturers. The quantities of single conductor steel-taped cable were divided into lots of from 10,000 ft. up to 400,000 ft. for delivery ranging from fifteen days to 165 days, thus giving the manufacturers a chance to bid on any or all items, or on whatever amount of added business they could handle at the delivery they could make, within certain limits. The low bidder on each item, of course, secured the contract, but in several instances the contracts were accepted contingent upon the delivery of steel to the cable manufacturers.

In addition to the 1,700,000 ft. of single-conductor, steel-taped cable called for by the specifications, there was also covered 53,000 ft. of steel-taped, two and three-conductor cable, 110,000 ft. of lead-covered cable and 30,000 ft. of cotton-covered cable, making the total cable called for 1,893,000 ft. Of this, contracts were let for 900,000 ft. of the first-class, 53,000 ft. of the second-class, 60,000 ft. of the third, and 10,000 ft. of the cotton-covered cable, making the total purchase 1,023,000 ft. Awards were made as follows:

To Julius Andrae & Sons Company, Milwaukee, agents of the Safety Insulated Wire & Cable Company, for 600,000 ft. of single-conductor No. 8, $119,240; to the American Steel & Wire Company for 200,000 ft. of single conductor No. 8, 22,000 ft. of two-conductor No. 8, 25,000 ft. of two-conductor No. 4, 2000 ft. of three-conductor No. 8 and 4000 ft. of three-conductor No. 4, $43,230; to the Boggis-Dietz Electric Company, Milwaukee, agents of the Simplex Wire & Cable Company, for 1000 feet of single-conductor No. 8, $17,600; to the Hazard Manufacturing Company for 50,000 ft. two-conductor No. 8, 10,000 ft. two-conductor No. 4 and 10,000 ft. three-conductor No. 4, $10,284. One company could furnish 200,000 additional feet of steel-taped cable for a price within 2 cents of the low figure, but not within the longest time allowed in the specifications; and in order to secure this cable legally, a second set of specifications were sent to all the manufacturers with a delivery clause of 165 days to 225 days maximum, with the anticipation, of course, that there will be only the one bidder, as the others took all they could handle in the first place.

The low-bid figures on the steel-taped cable at which purchases were made ran from 14.5 cents a foot for 200,000 ft. of single-conductor No. 8 cable, 165 days' delivery, to 20.42 cents, with a high bid of 20.75 cents for 400,000 ft. where delivery was required within 120 days. The average cost including the 200,000 ft. to be purchased on the new specifications at 16.5 cents for later delivery is 18.08 cents per foot. The bid on 200,000 ft. of No. 8 single-conductor for ninety days shipment was 19.88 cents, while bids for an equal amount, but for 105-day and 120-day delivery, was 20.42 cents. On these four items there was only one bidder, which was the same company in each instance. Likewise, another of the bidders quoted 14.5 cents for 200,000 ft. of single-conductor No. 8 in 165 days, and 16.5 cents for 200,000 ft. for 165 to 225-day delivery, which last will be a continuation of the same run of cable through the factory.

Here there is a most unusual condition of higher prices for later delivery and for larger quantities—the reverse of the usual market, both in respect to time and quantity. It points out the means resorted to by the manufacturer to protect himself against the uncertainties of the future. There were said to be no prospects for better prices, and indications are that conditions will be worse next year, especially in the face of a demand in Chicago alone for several million feet of steel-taped cable.

STEINMETZ ON CO-OPERATION

He Points Out Wherein the Municipality and the Central Station Have Been Remiss in Not Agreeing

In his vice-presidential address before the International Association of Municipal Electricians last week in Baltimore, the Baltimore Section of the National Electric Light Association also being present, Dr. C. P. Steinmetz outlined the benefits and the requisites of co-operation. In its larger aspects he traced the influence of co-operation and the lack of it on the nations of Europe, and the passing of competition and individualism for co-operative industrial organization.

Applying the subject to the electrical industry Dr. Steinmetz said: "Looking at the subject of co-operation, what we have to realize first is that co-operation implies two groups, two people, two organizations which participate. There can be no co-operation, for instance, where a municipality makes a law that within a year all wires must be put under ground, and then complains that the public utility corporation objects thereto and does not show proper co-operative spirit. There is no co-operation where one side makes a rule, law or proposition and expects the other side to submit, as, for instance, where the public utility corporation makes a proposition, 'We will charge you so much, now take it or leave it.' Co-operation implies coming together, both sides discussing the subject and coming to an agreement which is fair to both. This is not always realized.

"We are very much inclined to talk favorably of co-operation, but co-operation on our part consists in always asking the other side to accept our proposition. That is not co-operation. Let us realize when we begin to discuss co-operation that it means considering both sides and their views, to come together to an agreement. Another thing which we have to realize is that in attempting co-operation we must start from the premises that the other side is just as fair and honest as our side. If we begin by saying, 'Oh, yes, the

public utility corporation would be glad to co-operate with the municipality, if only we could get the political officials of the municipality to be fair with us'; or, if we are the municipality and say, 'We would be glad to co-operate with the public utility corporation if we could get them to be fair with the municipality.' As soon as we take this stand, the chance for co-operation is gone, as we claim, that we are the fair one and the other side is not fair. That is not co-operation.

EDUCATING THE MUNICIPALITY

"In regard to co-operation we must consider that the other side is just as honest and well-meaning as we are. They may be mistaken or they may be right. If we are right, then it is up to us to show them that the others are mistaken, by educating them, explaining the things to them, just as we do when we go out to a prospective customer and want to get him interested in not installing an isolated plant but to take central station service. We are not going to tell the prospective customer that he is a fool, and that the central station service is better, but we will carefully look at his view and see what he has to say and try to convert him if it is possible. The same thing applies to the dealings between industrial and municipal corporations. It means then that the beginning of co-operation is mutual education; it means open explanation of what we are driving at, what is our view, and what is the result to the other side. Unfortunately very little of that has been done. In reference to this, let us consider one feature as an instance: the cost of electric power.

LOAD FACTOR AND RATES

"There are very few people of the public at large, or in a municipality, who have any clear understanding how from the same central station the cost of electric power may vary over an enormous range. As an instance, a municipality buys electric power from the public utility corporation to drive the city pumping plant at materially less than 1 cent per kilowatt-hour. But this power is in large bulk, twenty-four hours a day, with a shutdown for a couple of hours during the peak load, and is taken directly from the long distance transmission line. At the same time the same company supplies the same municipality with power for lighting the city hall at something like 10 cents per kilowatt-hour.

"I am certain that at the rate of 10 cents per kilowatt-hour for lighting the city hall, the illuminating company is losing, that the power costs the company more than 10 cents a kilowatt-hour, due to the very poor load factor of that service. But it is not losing at less than 1 cent per kilowatt-hour for the pumping plant. Here you see power sold from the same system to the same customer in one case at less than 1 cent and in the other case at 10 cents, and the higher rate may be a losing rate and the lower rate is not a losing rate. The cost of electric power, and thus the question, What is a fair price? considering as a fair price the cost of production plus a reasonable profit, is not generally understood.

"But now let us ask how much work has been done, how many efforts have been made by the public utility corporations and their engineers to educate the people so that they will understand why it is that at the end of a distribution system, with a very poor load factor, supplying a large number of lamps lit up only a few hours every two weeks the cost of the power is very many times greater than for an off-peak heavy load directly from the station bus. But this is of essential importance for everybody to know to bring about the understanding of the relations between the power generating company and the power users. But practically no educational work has been done to explain the matter. This is what I mean: To begin co-operation we have to explain each other's attitude and listen to each other's explanation.

THE UTILITY AND THE COMMUNITY

"We must realize that the two organizations which have to deal with each other, the public utility corporation and the municipal corporation, city or municipality, are essentially dependent upon each other; while their interests in some respects may be antagonistic, they are no more antagonistic than are the interests of any other two corporations of producer and of customer.

"We all realize that while a public utility company may be a private corporation, it is not entirely private because it can carry out its function of supplying electric power only by using public property, the streets of the city. This gives the municipal corporation a certain controlling right, the right of controlling the municipal property in its use by the private corporation, and thereby makes the private corporation dependent upon the municipality. At the same time we must also realize that the private utility corporation is a part of the municipality and its failure is a municipal loss. We may find that the municipality is dissatisfied with the rates made by the public utility corporation. Well and good. Now, what can be done? The dissatisfaction may or may not be justified. We can build a municipal plant. But what then? Suppose the municipal plant is successful. Suppose we can supply from a municipal plant electric power somewhat cheaper to the consumers, to the customers, than from the existing private corporations; nevertheless, there is an economic loss to the municipality because it has destroyed industrial values; the value of the industrial corporation which is also a part of the municipality. Suppose, however, the municipal plant is a failure. Who pays for the loss? The municipality, the taxpayers, and the industrial corporation is a large taxpayer, and it also pays a part of the loss incurred by reason of the failure of the municipal plant. So you see the interests of the two are so closely related that the only way that should be attempted to obviate the difficulty is by reasonable mutual understanding, and such reasonable mutual understanding must be based on fair dealing in understanding each other's position and in explaining each other's position, and that is where the great mistake has been made.

"Public utility corporations, especially smaller ones, in dealing with large customers and private customers go to any length in explaining the service rules, explaining why isolated plants should not be built, why central station service is more satisfactory. But when they are dealing with municipalities, they have altogether too often taken the stand, 'We make a proposition, take it or leave it,' counting on the fact that the municipality has to take it. On the other hand, the municipalities altogether too often have considered public utility corporations as a good field to legislate against and get public approval by kicking the corporation. Now, both of those propositions are uneconomical.

BASIS FOR UNDERSTANDING

"The suggestion which I should wish to make is that we should endeavor to educate each other, to explain each other's viewpoint, because, as a rule, I find that where you disagree with somebody, if you can fairly explain your viewpoint and your reasons for it, and can have him fairly explain his viewpoint and the reasons for it, and listen to them with an open mind, while you may not exactly come to the same conclusion, you

can, in nine cases out of ten, come to an agreement. But you cannot do so if each one stands pat and refuses to make any modification or explanation or anything else. When you come to think of it, the municipal power demand from a public utility corporation is very similar to that of an isolated plant, and the attitude toward the municipality as a consumer should be modeled according to the attitude toward an isolated plant or an attempt to consider the advisibility of an isolated plant.

"When a big hotel is built or a big office building, the builder and manager thinks about the power proposition, and naturally his first idea is to put in an isolated plant, because he figures that he can produce his electric power cheaper than he can buy it from a central service station. Here is where the station man has to come in and explain why it is more economical to get central station service. The same attitude should be used in relation to the municipality. The same principle applies where a big factory considers the question of having its own electric plant or the alternative of having a central station service. In most cases probably when the problem arises, and a new factory is built, its management does not consider at all the advisability of having central station service. It is up to the central station to explain and get the prospective customer to consider the possibility that perhaps he can buy more economically than he can produce power.

"We know that there are big, modern railway power stations standing idle because it does not pay to run them, but it is more economical to buy the power from a central station. This is not obvious on the surface. It was not plain, but it meant a great deal of education to explain it and show it and prove it. Now, that explanation and education is the foundation of getting together. Very little has been done in the matter of the relations between the utility company and the municipality. There is where the beginning must be made to bring about closer co-operation, such co-operation as will be necessary in years to come, if we, as a nation, desire to keep our standing against a reconstructed cooperative Europe."

BALTIMORE CONSOLIDATED GAS & ELECTRIC REPORT

Company Shows Gross Income of $7,431,769 for Year Ended June 30, 1916—Electric Sale Increase 17.6 Per Cent

Showing the best year in the history of the company, the annual report of the Consolidated Gas, Electric Light & Power Company of Baltimore, Md., has just been issued covering operations for the fiscal year ended June 30 last. Every phase of the company's activities during the twelve months is discussed at length by President Herbert A. Wagner.

Gross income shows an increase over the previous fiscal year of $642,366.94 or 9.5 per cent, and the net earnings an increase of $370,873.71 or 11.5 per cent. On a strictly comparable basis, eliminating the reserve called upon last year for new business expenses, the net earnings show an increase of $495,874 or 16 per cent.

Gross income from electric sales increased $580,466.45, or 17.6 per cent, and the gross income from gas sales increased $84,955.14, or 2.5 per cent. These gas figures, however, do not indicate the real increase in gas output, owing to a reduction in gas rates.

The continual growth and development of the city and its surrounding territory, and also of the large industrial fields supplied by the company and the consequent increase in the use of both gas and electricity, required expenditures during the year for extensions, improvements and betterments of the company's properties and plants, completed and in the course of completion, as follows: Gas properties, $515,864.96; electric properties, $882,711.21; total, $1,398,576.17.

The growth in electric earnings and output of the company is shown in the following comparison:

	1916	1915	Increase	Per Cent
Gross income from sale of electricity	$3,881,665.96	$3,301,199.51	$580,466.45	17.6
Electricity sold, kilowatt-hours	183,475,608.0	126,933,209.4	56,542,398.6	44.6
Customers	43,527	38,419	5,108	13.3

During the year the company has contracted for and is now completing the installation of a steam turbine and generator with a capacity of 20,000 kw. as an addition to its steam generating station. Substantial increases in sub-station capacity and in transmission and distribution lines have been made to serve the increasing demand for power and light. Approximately 112 miles of cable were added to the underground transmission and distribution system.

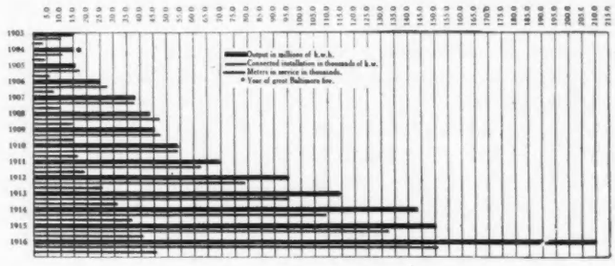


DIAGRAM SHOWING OUTPUT, CONNECTED LOAD AND METERS INSTALLED

The total output of electricity for the year was 210,211,278 kw.-hr. Of this amount there was purchased from the Pennsylvania Water & Power Company, supplied by its hydroelectric plant, 193,428,100 kw.-hr., representing 92 per cent of the Consolidated company's total output.

The plan inaugurated last year to mutualize the interests of the company and its consumers through the sale of common stock, on deferred payments of $4 per share per month, is still effective, and the results are satisfactory. On June 30, 1916, 1257 consumers were purchasing 6363 shares, the aggregate purchase price being $686,774. The initial subscribers under this plan will have paid for their stock in full in July of next year, at which time full-paid certificates will be delivered; meanwhile, as payments continue, interest is allowed at the rate of 6 per cent per annum, compounded quarterly.

A comparative statement of income and expenses for 1916-1915 follows:

			Fiscal Year Ended June 30, 1916	Fiscal Year Ended June 30, 1915
Gross income			$7,431,768.81	$6,789,401.87
Operating expenses and taxes			3,848,076.37	(a)3,576,583.14
Net earnings			$3,583,692.44	$3,212,818.73
Fixed charges			1,580,057.77	1,640,361.31
Net income			$2,003,634.67	$1,572,457.42
Dividends paid and payable			1,131,803.49	1,064,628.89
Surplus			$871,831.18	$507,828.53
Reserve for depreciation, amortization, etc.	1916 $550,000.00	1915 $460,000.00		
Reserve for contingencies	134,541.82	47,828.53		
Charged off to bond discount	90,000.00	.....		
			774,541.82	507,828.53
Net surplus			$97,289.36	.....

(a) Does not include New Business Expenses and Extraordinary Expenses, amounting to $125,000 for 1915, charged to "Special Reserve for New Business Campaign and Extraordinary Expenses."

Downtown Lighting System for San Francisco

Combination of Trolley Poles and Lighting Standards of Dignified Artistic Designs on Market Street—Flood Lighting of Building Façades and Use of Toned Glassware Results in Distinctive Lighting

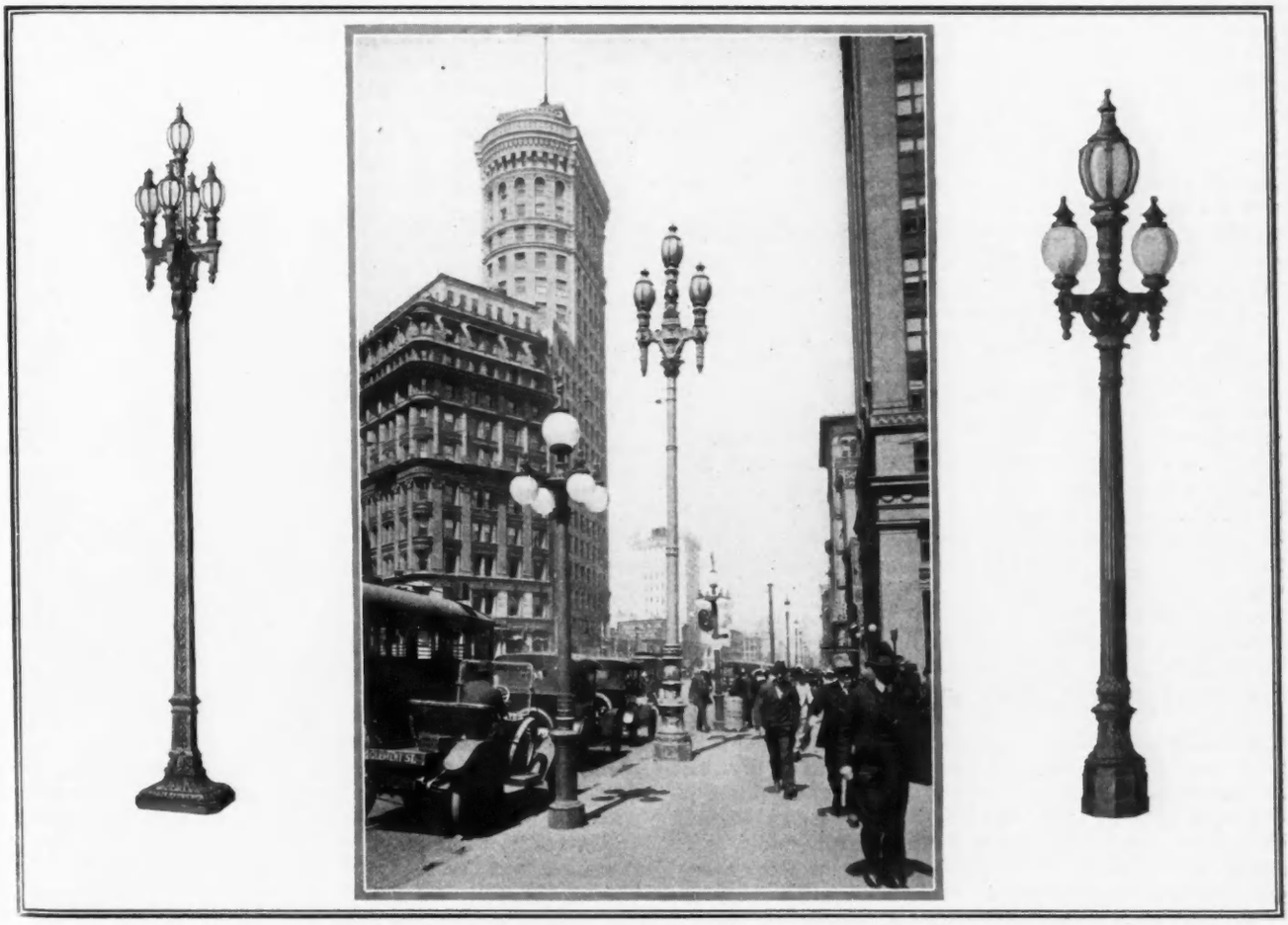
BY WALTER D'ARCY RYAN

THE local effect of the Panama-Pacific International Exposition lighting has resulted in a determination on the part of the people of San Francisco to perpetuate the illumination in so far as possible by lighting the main business streets of the city, largely by the use of the high-current luminous arc lamps which were used extensively for façade and avenue lighting at the exposition.

The new lighting system for San Francisco is divided into three groups, according to the type of standard employed:

1. Market Street and the Ferry Plaza.
2. Downtown retail business district and New Montgomery Street.
3. Union Square and the civic center.

The inauguration of the lighting of the first group, to be designated the "Path of Gold," will be celebrated by an illumination carnival on Sept. 20 and 21. The



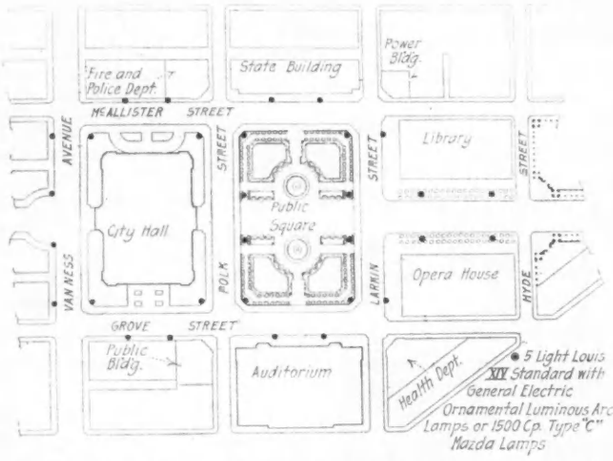
TYPICAL FORMS OF ORNAMENTAL LIGHTING STANDARDS ADOPTED IN SAN FRANCISCO SINCE THE EXPOSITION

Shown at the left is a 5-lamp post which has been adopted for the Civic Center and Union Square and will carry either luminous arc or Mazda C lamps. In the street view, which was taken on Market Street looking toward Ferry Plaza, may be seen a 3-lamp luminous arc standard which represents the first new type erected. At the right is a 3-lamp standard intended for the downtown business triangle section and New Montgomery Street, which will carry one luminous arc and two Mazda C lamps.

city of San Francisco is preparing unusual decorations for the streets, building fronts and show windows, and many novel features to entertain the thousands of visitors during the celebration, which will be of the Mardi Gras order. The principal features will be the lighting of Market Street, the Ferry Plaza and New Montgomery Street, the illumination of the Ferry Tower and new City Hall, an illumination parade with floats depicting the history of lighting from the cave days to the present time, dancing and general carnival in the street, the firing of time flares for the taking of moving pictures, a special fireworks display, an illuminated aeroplane flight, an illumination ball at the Civic Auditorium and a fashion show.

Lighting of Market Street and Ferry Plaza

The initial Market Street installation extends from the Ferry Building to Seventh Street, a distance of



ARRANGEMENT OF LAMP STANDARDS PROPOSED FOR CIVIC CENTER PICTURED IN HEADPIECE

approximately 1½ miles, including the Ferry Plaza of the Embarcadero.

The system which is being replaced consisted of one direct-current inclosed arc lamp on the top of iron trolley poles. These poles were designed by Willis Polk, chairman of the architectural commission of the Panama-Pacific International Exposition, and modeled by Arthur Putnam, a sculptor of international fame. It was decided to utilize these poles with a tri-unit top, which has also been designed by Willis Polk, and modeled by Leo Lentelli, one of the noted sculptors of the exposition. There are 143 poles now being converted. The over-all dimension of the new standard is 32 ft. and the average distance between poles 110 ft. Each of these is surmounted by three General Electric ornamental luminous arc lamps, which were taken from the exposition and modified by the addition of a new sectional globe with special "San Francisco Gold Carrara" glassware. These lamps are grouped in the form of a triangle, with its plane transverse to the street. The poles are being painted in imitation bronze, with a strong Verd-antique finish, which blends happily with the golden color of the glassware. The general effect is very pleasing and will add materially to the dignified appearance of the street by day as well as by night.

The glassware was made by the Gleason-Tiebout Company in collaboration with the writer, and is very much less insistent than the ordinary white or opal glassware commonly used. The absorption is practically the same as white Carrara of the same diffusing quality.

It was decided to depart from the usual title "White Way" and call this installation "Path of Gold," more on account of the day appearance. The effect of the light by night will be a warm white and far removed from the broken red-yellow color of the flame arc. It will also be whiter and of a different character than the Mazda light. This will still maintain a good contrast with the window lighting and the street signs, which, of course, are much warmer in tone.

Lighting of New Montgomery Street

The Board of Harbor Commissioners is installing eighteen lamps on six three-light standards in front of the Ferry Building, and will also improve the lighting of the Ferry Tower. The Palace Hotel is extending the system down New Montgomery Street with ten three-light standards, each having one ornamental luminous arc and two 200-watt Mazda lamps, inclosed in gold Carrara glass, the same as used for the arc lamps, but of somewhat lighter density.

The initial installation when completed will consist of 411 lamps on Market Street, eighteen lamps in front of the Ferry Building, and ten lamps on New Montgomery Street, making a total of 439 lamps.

The Pacific Gas & Electric Company has assumed the entire cost of the installation, including lamps, cable and underground system, modification of the poles, station equipment, etc., at a cost of approximately $100,000. Owing to the city charter, which does not permit of a street lighting contract extending for a period of more than one year, and since it was necessary for the Pacific Gas & Electric Company to have a guarantee for at least three years, a contract was arranged with the Downtown Merchants' Association, which has been instrumental in the promotion of the system, to assume all financial obligations for the merchants and property owners, thereby making it unnecessary for the Pacific Gas & Electric Company to deal with individuals. While the contract was arranged on a three-year basis, the cost was predicated over a longer period, on the natural assumption that the system would be in operation at least from seven to eight years before improvements in the art would be sufficient to warrant a change. A separate contract has been arranged with the management of the Palace Hotel and with the harbor commission on a five-year basis.

The United Railroads has incorporated in its franchise with the city an agreement to maintain one lamp on each pole on Market Street at a cost of $48 per year. This amount is to be applied with the Downtown Merchants' Association fund for the maintenance of the two side lamps which are to burn until midnight. The city will maintain the center lamp on all-night service. The rate for the all-night lamp is $96.73 each per year, and the midnight lamp $78.48 per lamp per year, making a total for merchants, property owners and the United Railroads of $21,503.52 per annum, the city $13,252.01, the harbor commissioners and the Palace Hotel approximately $2,700.

Triangle Section of the Downtown Business District

The illumination of the triangle section of the downtown business district, bounded by Powell, Post and Market Streets, will probably be completed by Dec. 1. At the present time there are in use five-light clusters with one 40-watt lamp in each of the bracket globes and two 25-watt lamps in the center globe. These standards will be replaced by a new design by J. W. Gosling of the Illuminating Engineering Laboratory of the General Electric Company, who also designed the five-light standard for the civic center. In character it is very similar to the Market Street standard, except that it is 18.5 ft. over all and carries one 6.6-amp. luminous arc in the center, with the gold Carrara sectional

globe, the same as on Market Street. This unit will be maintained by the merchants and property owners at a cost of $110 per lamp per year on midnight service. The standard also carries two 100-watt Mazda "C" upright bracket lamps, each inclosed by an oval-shaped gold Carrara globe, 14 in. in diameter, of the same type as used on New Montgomery Street. The city will maintain these lamps at a cost of $54.75 per standard per year on all-night service. It is interesting to note that this is probably the first time that arc and incandescent lamps have been artistically combined on a single standard for street illumination.

The present lighting standards are spaced approximately one to each 80 linear feet of street, arranged in staggered formation. With the new system some advantage would be gained by relocating certain poles, but for economic reasons, existing locations will be maintained so that the present distribution system can be used for the incandescent lamps without modification. This system will be supplemented by underground series arc circuits.

The initial installation will include approximately 110 standards and will probably be extended in the near future. The Pacific Gas & Electric Company has made practically the same arrangements with the Downtown Merchants' Association as for the Market Street lighting, except that the contract is on a five-year basis.

LIGHTING OF THE CIVIC CENTER AND UNION SQUARE

The civic center comprises a group of city buildings, including the new city hall, library, civic auditorium, power building and emergency hospital, to which will be added a State building, opera house, fire and police department building and public building. The buildings erected and proposed are all of monumental character, and inclose a grand plaza. For architectural reasons, and to leave the main vistas free from unnecessary obstruction, the projected lighting system calls for the grouping of the lamps at the smallest number of points consistent with good lighting effect. There are thirty standards of Louis XIV design, which harmonize with the exterior building decorations. The over-all dimension of these standards is 37 ft. It has not yet been determined whether 6.6-amp. luminous arcs or 1500 cp. Mazda C lamps will be used. In either case they will be inclosed in gold Carrara sectional globes, as shown in the accompanying illustration. Six standards of this same type will be installed in Union Square for the lighting of the park.

Briefly, the principal feature of the lighting system by day is the combination of the trolley poles and lighting standards in a dignified, artistic design, free from obtrusiveness, which will add greatly to the character of the streets, and by night an economical combination of utilitarian and display lighting which will flood the building façades as well as the streets with a warm, pleasing illumination, which is supplemented with a slight suggestion of the carnival, produced by the tone of glassware, the grouping of the lamps and the artistic treatment of the standards. This will give Market Street, particularly, a distinctive character, and should result in a general tendency toward better and more aesthetic commercial street lighting.

NEW LIGHTING SYSTEM FOR CITY OF ROCHESTER, N. Y.

Substitution of Gas-Filled 600-Cp. Units for 7.5-Amp. Inclosed Arcs Operated at the Same Rate

The work of replacing 2500 series inclosed 7.5-amp. carbon arc lamps in the city of Rochester, N. Y., has just been completed and a new system employing 2500 series Mazda C 600-cp. lamps was placed in operation on Sept. 1, 1916. In the accompanying illustrations is shown the attractive standard which has been employed on University Avenue, harmonizing admirably with the architecture and providing adequate illumination among the large shade trees which line both sides of this street.

The post shown carries a 20-amp., 600-cp. gas-filled lamp in an 18-in. ventilated opalescent globe supported on an ornamental cast-iron case, which incloses the compensator. This case and globe is mounted on a 10-ft. octagon fluted concrete standard, which measures 12 ft. from center of the globe to ground line. Service cables run up the center of the pole to the lamp.

The original standard used for a 7.5-amp. inclosed carbon arc lamp has been employed in the installation of the 20-amp., 600-cp. incandescent units in certain sections. The mechanism of the arc lamp was removed so as to use the case as a container for the compensator of the gas-filled unit. The lamp is connected to the 7.5-amp. series alternating-current 60-cycle circuit as in the previous case, so that little circuit remodeling was required. The estimated annual load for the new system is 5,050,000 kw.-hr. The rates charged are the same as for the old system, namely, $68 per year per lamp for the underground distribution and $57.95 per lamp per year for the overhead distribution.

FIGS. 1 AND 2—CONCRETE ORNAMENTAL STANDARDS INSTALLED ON UNIVERSITY AVENUE, ROCHESTER, N. Y.

SUMMER RESORT LAMP POST CONSTRUCTION

How Ornamental Posts at Spring Lake, N. J., Have Been Equipped with Summer and Winter Units and Post Bases Used as Junction Boxes

BY S. W. BORDEN
General Manager Lakewood & Coast Electric Company

During the spring of 1915 the Lakewood & Coast Electric Company of Point Pleasant, N. J., installed for the Borough of Spring Lake sixty ornamental standards for street lighting, forty of which are suitable for 600 candle-power lamps and twenty for 100 candle-power lamps. The large standards are equipped with individual transformers which have secondary taps provided so that either the 600 cp., 20-amp. lamp, the 400 cp., 15-amp. lamp, or a 72-watt, 12-amp. lamp can be used. It was essential to provide these various ranges due to the fact that Spring Lake is a summer resort and the street lighting required is materially reduced during the winter months. The lamp socket holders were made adjustable in order that the center of the lamp might coincide with the center of the globe irrespective of what lamp might be in use.

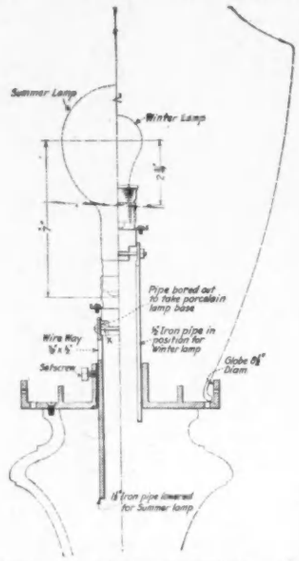


FIG. 1—LAMP POSITION ADJUSTER FOR SUMMER AND WINTER UNITS

The standards were installed on concrete foundations which were cast hollow and these hollow foundations are used as man-holes for the installation of type S. L. General Electric transformers for feeding traffic signs, drive lights, bridge lights, or any other circuit which it is desirable to feed from the series circuit, but which it is essential to insulate therefrom. Steel armored duplex 2200-volt underground primary cable has been laid in several streets, the cable being brought into each of these hollow foundations at which point taps are taken off for running down side streets, into vaults either inside or outside of private dwellings, or to distribution poles in the rear of dwellings.

COST OF SPRING LAKE (N. J.) LIGHTING INSTALLATION

Total cable laid 23,524 ft. No. 8 single and 5053 ft. No. 6 duplex, making a total of 28,577 ft. Cost of cable at freight house	$2,861.57
Cost of installing and connecting cable:	
Labor for digging and rolling down trench, 23,000 ft.	$1,223.43
Foreman and jointers' wages, board and expenses	426.40
Cartage	55.00
Miscellaneous material and supplies	22.28
Total cost of installing and connecting	$1,727.11
Cost of installing one dollar's worth of cable	60 cents
Total cost of laying cable per foot of trench	7.5 cents
Total cost of laying cable per foot of cable	6.05 cents
Large standards, casting only, cost at freight house	$15.00
Small standards, casting only, cost at freight house	13.00
Special transformers, each	9.00
Foundations, each	4.00

The total cost of labor and material for the sixty standards and their concrete foundations, armored cable, sockets, wiring and miscellaneous material for connecting, all in place and ready to light, with the exception of the bulbs themselves and any overhead expenses beyond that of the general foreman, was as follows:

FIG. 2—LAMP STANDARD INSTALLED AT SPRING LAKE, N. J.

Material, $4,127.94; labor and all other expenses, $1,494.80; average per standard, $93.70. The estimated cost of the installation was $102 each for the large standards and $88 each for the small standards.

The foundations were installed by a local contractor, and the cable was furnished, installed and connected to the standards by the Safety Underground Wire & Cable Company of New York. The installation work was done by them on a penalty and bonus basis, the resultant price being cost plus 30 per cent. The standards were purchased, wired and erected by the construction force of the Lakewood & Coast Electric Company.

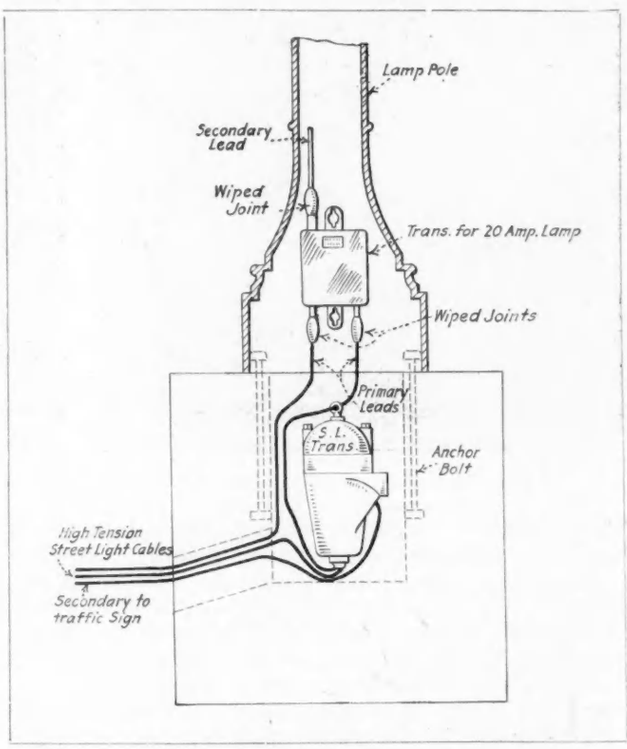
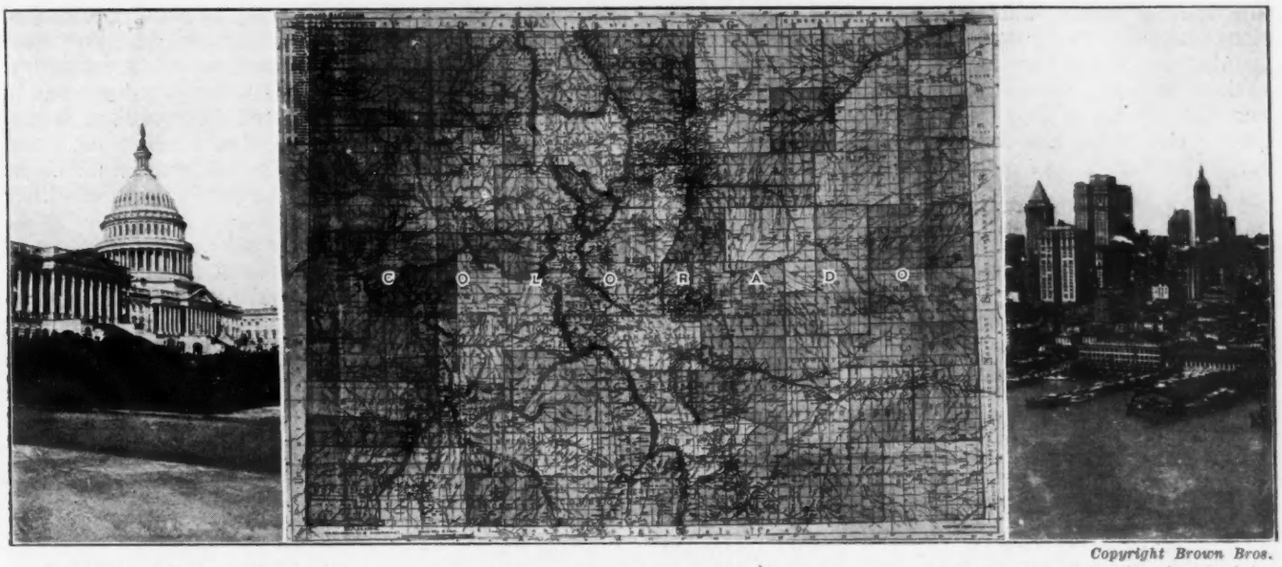


FIG. 3—LAMP POST FOUNDATIONS USED AS JUNCTION BOX



The annual income in the electrical industries is equal to the total annual expenditures of the United States Government.

As many persons are employed in the electrical industries as are found in the entire State of Colorado.

The investment in the electrical industries is equal to the assessed valuation of real property and improvements in Greater New York.

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Mobilization of the Electrical Industry

Impressive Showing of Great Resources and Forces of Employees in the "Greater Electrical Industry," the Power of Peace Which Will Be Prepared for Industrial Defense

A MOBILIZATION of the electrical industry—even on paper—is an impressive showing of great resources and forces of employees. People speak of "the electrical industry" without realizing the full extent of its enormous power and possibilities for constructive achievement. They talk of some single one of the branches without appreciating the larger accomplishments that a co-ordination of all branches may effect. It is easy to overlook the larger measure of the capital and labor engaged and to forget the united front which may be presented for the common welfare.

It is the desire of the ELECTRICAL WORLD to demonstrate the present scope of the Greater Electrical Industry. The potential possibilities, which the statistics do not reach, would stretch much farther than even the wide limits shown by the existing properties. An appraisal of present values in the industry discloses suggestive lines for co-operation and emphasizes the fact that the absence of such an attitude means the loss of opportunities.

The preparedness movement which the engineers of the country are patriotically conducting is the first necessary step toward a real mobilization, and is of vital concern to all electrical organizations. The committee of the Naval Consulting Board, the co-operating committees in every state and the thousands of unnamed members of the engineering societies who are contributing their share are doing a work without pay in which they are actuated by the highest considerations toward their country.

MOBILIZATION OF INDUSTRIAL RESOURCES

Mobilization in every department of life is the policy of the times enforced by world conditions; mobilization for warfare in Europe and wherever the warring countries have interests at stake; and in this country there is, as never before, an earnest desire to gage prudently our industrial resources and means of defense so that if aggression comes the nation will have taken preliminary steps in preparedness.

In some parts of the industry the war in Europe has caused real mobilization, as in those plants which have taken munition orders. It has led to a test mobilization in, for instance, the telephone industry. Every feature and part of the Bell system were available in the experimental trial which was made in May of the present year. Four types of facilities were placed at the complete service of the government—telephone service by wire and by wireless, telegraph service and long lines printer service. Of the 27,300 miles of pole line in the American Telephone & Telegraph Company long distance lines department 14,300 were involved in the mobilization of the forces of communication. Of the total of 18,505,545 miles of wire in the department, 52,214 miles were in use.

Peaceful mobilization in the electrical industry is a closer union of all interests for a helpful purpose. Commercial and engineering ideas in the electrical industry

ELECTRICAL INDUSTRIES OF THE UNITED STATES

	Investment or Capitalization	Persons Employed	Annual Earnings or Sales
Central electric stations..	$3,038,000,000	104,000	$403,300,000
Isolated electric stations..	1,519,300,000	52,000	201,600,000
Street and electric railways — power generation, distribution and application	2,681,800,000	165,000	350,500,000
Street and electric railways — railway operation	2,681,800,000	165,000	350,500,000
Electrified divisions of steam railroads.....	204,700,000	15,000	30,300,000
Telephone	1,262,760,000	237,000	329,900,000
Telegraph (land and ocean)	231,600,000	44,000	75,300,000
Electric machinery, apparatus and supplies (including electric products of other industries)....	469,100,000	185,000	383,300,000
Electrical dealers and contractors	15,000,000	50,000	120,000,000
Electrical jobbers	25,000,000	6,000	80,000,000
	$12,129,660,000	1,023,000	$2,324,700,000

In general, most of the estimates are based upon returns of the United States Bureau of the Census. A comparison of the estimates in different sections of the industry on isolated electric stations made it apparently reasonable to assume that the totals for this branch are one-half of those for central stations.

Statistics for the electrified mileage of steam railroads are based upon the latest available figures of miles of track to which were applied the approximate averages of electric and steam railroad statistics. The very costly terminals were not taken into account.

are thoroughly developed or capitalized. Different sections and interests in numerous geographic parts of the country are joined together through the medium of the various national associations which successfully represent the country-wide aspect of an organization movement. Generally, however, these associations serve a particular part of the industry or a restricted purpose.

Breadth and Strength of the Industry

The statistics which are published herewith point to a larger view of its breadth and strength which the industry may adopt.

By comparison with other statistics the totals become more impressive. The aggregate number employed in the electrical industries is 10 per cent of all of those engaged in manufacturing industries of the country, and over 2 per cent of all gainfully employed persons in the United States. The total of 1,000,000 employees represents the combined population of Baltimore and Buffalo or of San Francisco and Los Angeles; it is as many people as are found in the entire state of either Colorado or Florida.

The amount of the investment shown is equivalent to about the assessed valuation of real property and improvements in Greater New York. It represents over 5 per cent of the total wealth of the United States. If

THE GREATEST AGGREGATION OF RELATED INDUSTRIES IN THE WORLD

By HERBERT A. WAGNER

President of the National Electric Light Association and President of the Consolidated Gas, Electric Light & Power Company, Baltimore

Ordinarily but few people, not directly interested, stop to think or inform themselves of the enormously important part that electricity plays in our modern civilization.

The statistics given here in regard to the greater electrical industry are amazing, even to those who are engaged in the electrical arts. In all our cities we have become absolutely dependent in our daily pursuits and avocations upon electrical public service in the form of power, light, transportation, and communication by telephone and telegraph. Day is lengthened into night, and our homes and thoroughfares are made safe by it. Distances are eliminated and the wheels of industry are turned by this mysterious but faithful agency. Without it, friends, families, business enterprises, cities and countries would be isolated and business would be at a standstill. The life and enterprise of nations have been revolutionized in half a century by this infant giant, which has been chained and trained for the service of humanity.

But not only are industries dependent upon it; its application, development and extension have built within it and of it the greatest aggregation of related industries that the world has ever seen.

In the conduct of this great industry the adoption and standardization of the most improved and intensive methods, the manufacture and installation of the most highly efficient generating, distributing and utilization apparatus, and the establishment of welfare and educational activities, have gone hand in hand and are evidences of the development of the highest efficiency in management and individual.

The public realization of these conditions in the industry is shown by the increasing attention given by investors to electric public service securities as being the most stable of all in times of business depression. An improved sentiment toward public service corporations has followed their close co-operation with state regulatory commissions and an enlightened public policy.

A strong energizing and educational factor in all this growth has been the National Electric Light Association, composed of the public service electric companies and their employees, which has itself developed into the world's largest and most active technical organization.

In short, the electrical industry is not only growing rapidly and reaching enormous proportions, but it is also qualifying as the most highly efficient, progressive and intelligently conducted industry, and taking the lead in the industrial development of the entire country.

The youth, romance and amazing development of the electrical industries have attracted the flower of the land in brains, education and energy. From this youthful and dynamic congregation of the country's most highly trained men there is no undertaking for industrial development or national preparedness which could not be magnificently organized and carried through. In the public service and its supporting industries, constituting the greater electrical industries, the individual has been developed and trained in discipline and efficiency to the highest degree ever attained, and on these men the country can depend for the most loyal and effective service in any time of need or emergency.

ELECTRICAL INDUSTRY AT THE FOUNDATION OF DEFENSE

By HOWARD E. COFFIN

Chairman of the Committee on Production, Organization, Manufacture and Standardization of the Naval Consulting Board

In the event of war every industry would be called on to serve. Two years of the European war have brought home to us one great lesson: That true preparedness for national defense can exist in this country only through such an organization as, in the event of an emergency, will place our manufacturing and producing resources instantly in the government service. And any plan for the protection of this country against invasion can be made effective only through the perfection of such an organization during the normal times of peace. Every manufacturer must take this lesson of the European war home to himself and must realize his responsibility under it.

In the event of any future war with a first-class power every manufacturing plant within the boundaries of this country will be called upon to do its part for national service. Every manufacturer must demand therefore that he be taught in time of peace to make that one thing or part for the government for which his equipment and the training of his men best fit him, and which he will be required to supply, for the support of either the active fighting forces or the civilian population, in time of emergency.

In the plans for national defense no industry will play a more important part than the electrical industry. This industry lies at the very foundation of things military, both on land and on sea. In the event of war many of the great factories developed to produce electrical apparatus will be called on to concentrate on electrical machinery necessary in every branch of military service. Whether it be for wiring, for ignition apparatus, for aeroplanes, motor vehicles and mines, whether it be for the delicate controlling apparatus of battleships or for great plants for extracting nitrogen from the air, the electrical engineer and the electrical art will be of the most vital importance.

Of course, under the actual conditions of war not all of the electrical plants could continue to produce electrical equipment. Many would be converted to other products. The machinery used in the manufacture of electrical apparatus lends itself to a diversity of war needs, and labor skilled in this industry is especially qualified to handle work of the accuracy required in the making of shell fuses, detonators and other items of like precision and importance.

In demanding that, through prearrangement, his manufacturing facilities shall be made readily and quickly available for the government in case of need the manufacturer at the same time serves his own best interest. He insures the operation of his plant at a reasonable profit in spite of the chaotic commercial conditions attendant upon war and that his labor forces, built up over a long period of years, will be maintained intact as an integral part of the industrial reserve.

There is no more important link in the chain of industrial machinery entering into the national defense than the great central stations upon which manufacturing companies are dependent for power, and the uninterrupted operation of these sources of industrial energy must be assured at all hazards in war as well as in times of peace. Telephone and telegraph also are indispensable instruments in the program for successful defense of the country.

every inhabitant of the country contributed $100 the total sum thus obtained would not meet the capital cost of the properties as they are given in the table.

The gross income of $2,000,000,000 is about the same as the total annual expenditures of the Federal government. It is equal to the value of the annual production of all lumber and timber products in the United States. It is a sum greater than the value of the annual output of all mines and of quarry products in this country.

Between the different arms of the greater electrical industry the manufacturer furnishes a point of connection. He must provide all but the relatively small proportion of imported apparatus. Central station, railway, telephone, telegraph and isolated plant meet at the door of the manufacturer for the materials which they use.

Tremendous Buying Power

It is impossible to avoid the suggestion of tremendous buying power in the totals of capitalization and earnings. So large is the normal rate of expansion upon which some of the properties depend, notably the central electric stations, that it is only by continued extensive investment planned in advance with care and foresight that they are able to keep up with the demand for service. Large as the suggested buying power is, it becomes even greater when one considers the fact that customers of electric central stations are immediately potential users of appliances.

Outside of the central stations the same important influence of great buying power is exerted. One interesting instance, upon which the statistics do not touch, is that of the mining and industrial railways operated by electricity. The extent of the application of electrical energy in mining operations is much greater than is realized generally.

It is interesting to consider the position of the electric railway and the electrified mileage of steam railroad properties. These are essentially identified with the tremendous transportation industry, which in time will probably be completely electrified, thus adding greatly to the already large totals for the Greater Electrical Industry.

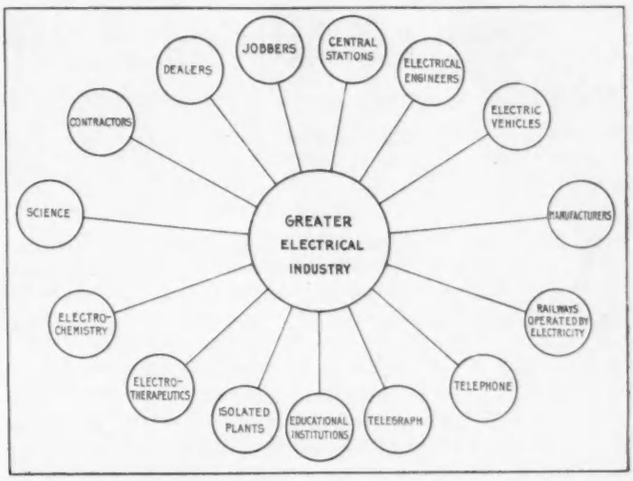
Frequently the central station business is spoken of as an industry by itself. This is true also of the electric railways, of the electrical manufacturers and of the respective properties engaged in the telephone and telegraph business. Yet all of these rightly combine to form the extensive electrical industry.

Essential Service and Workers

The absolutely essential character of the service which the workers in these groups of industries render is one of the striking causes of their influence. Highly trained in mind and body, these workers would be invaluable to the country in a time of war. The question of what can be done with such an industry when it is following the ordinary commercial pursuits of peace is one which it answers sturdily for itself by pointing to ever-increasing totals of earnings. Any who ask what such an industry would perform in the event of war may read the answer in the statement in which Howard E. Coffin points to the importance of electrical plants in the far-reaching plan of industrial defense which is being perfected under his guidance.

Potential Growth of the Associations

Another view can be taken of the potential forces of the Greater Electrical Industry. This is an estimate of the possible number of men who could be brought together in various associations within the industry. Necessarily this view involves duplications where the interests of potential members would take them into more than one organization, but it is none the less interesting. Secretary T. C. Martin of the National Electric Light Association, which has a membership of 15,000, estimates that if all of those who were available should be enlisted the enrollment would reach 50,000.



Peaceful mobilization in the electrical industry is a closer union of all interests for a helpful purpose.

F. L. Hutchinson, secretary of the American Institute of Electrical Engineers, makes the rough guess that possibly 50,000 men in the United States might be considered eligible for membership. A great majority of these, of course, would be eligible for admission to the grade of associate only, and not to the grades of member or fellow. The membership of the A.I.E.E. on July 1, 1916, was 8268.

Joseph A. Andreucetti, secretary and treasurer of the Association of Railway Electrical Engineers, which has now approximately 500 members, estimates that if the entire available membership in the railroads were enlisted, it would increase the total by about 1500.

David Sarnoff, secretary of the Institute of Radio Engineers, calculates that if all of those who are or should be interested in the radio art were to join the organization there would be a membership of approximately 5000.

The Railway Signal Association comprises about 950 active and junior members, and C. C. Rosenberg, the secretary, expresses the opinion that about 80 per cent of these are men who have more or less to do with electrical apparatus, either in installation or maintenance.

The Association of Iron and Steel Electrical Engineers has a membership of 415, and would be enlarged if all of those who are eligible were to join.

The present approximate membership of the Illuminating Engineering Society is 1300, and this total would be swelled materially if all of those who are engaged in the direct application of illuminating engineering or the manufacture of appliances should be enrolled.

With its present large membership of 17,000, the Jovian Order also has great possibilities of development by enlistment of additional numbers of those who believe in its useful work.

The National Electrical Contractors' Association, containing in its membership the nucleus of this important branch of the industry, also has a large field for future growth.

The Larger Future

Every one who is a part of the growth of electrical progress will predict unhesitatingly that the future will far outstrip the past. For he has seen the most amazing prophecies come true. Striking, confident assertions of one year are borne out in the material developments of the following year. Old hopes are realized and the new vision of accomplishment is pushed farther ahead.

Street Lighting System of Sheboygan, Wis.

Method of Laying the Cables—Arrangements for Holding the Lamp-Post Anchor Bolts During Concreting—All-Night and Half-Night Circuit Arrangements

BY CARROLL H. SHAW
Electrical Engineer, Sheboygan Railway & Electric Company

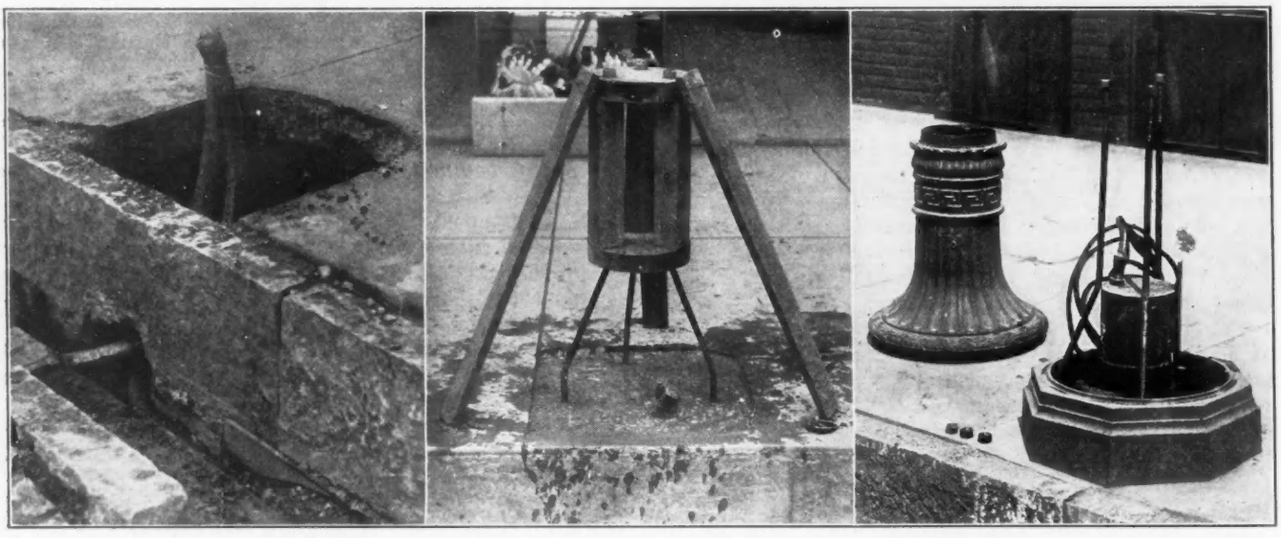
A NEW ornamental street lighting installation has been recently put into operation in Sheboygan, Wis., which has several rather unusual construction and operating features. The system consists of 112 400-cp., 15-amp. Mazda C series lamps, supported at a height of 14 ft. 6 in. above the curb and installed opposite each other with six units to a block on each side of the street. At the street intersections the posts are placed 3 ft. outside of the cross-street property line, and are 74 ft. apart. Since the blocks are 398 ft. in length, the intermediate units are spaced slightly less than 65 ft. apart.

In the installation of the system, which extends for nine blocks on the main business street of the city, it was found possible to lay the cable just outside of the sidewalk curb. The street is paved with brick laid on a sand cushion 2 in. deep, with a concrete foundation 6 in. thick. The two courses of brick next to the curb were laid parallel to the curb, and except at the street intersections and at some points where the curb had been forced out against them it was found possible to remove these two rows of bricks without disturbing the main paying in any way. The sand was carefully removed down to the concrete and the cable laid in the trench thus formed. Small hand holes had been previously drilled through the curbing at the point where the posts were to stand for the cable to be pulled through. When laying the cable a 30-in. lap was allowed for each post. The cable was then pulled through the hole in the curb, and concrete was poured into the trench to completely incase the cable, thus leaving the street with a surface as good as before. At the street intersections slightly narrower brick were used instead of the concrete so the construction would not be noticeable.

The posts are of the pressed steel type, made by the Union Metal Manufacturing Company of Canton, Ohio, and are made up of two sections, the base and the shaft, making a unit 13 ft. high and holding the lamp center 14 ft. 6 in. above the curb. As soon as the trench filling was hard the post foundations were put in. The excavating had been completed before any of the finishing work was started in order that the cables might be pulled through. The foundation, which was 18 in. square and 18 in. deep, was put in around the three ground rods on the day following that in which the cable was laid. The method of handling this work is clearly indicated in the accompanying photographs. The templets were designed to support the ground rods rigidly at the height at which they would be required to hold the base of the post. Six of these templets were provided, this number being found sufficient for the installation of all the posts, since any variation in the height of the posts could be obtained by changing the shaft instead of adjusting the base.

After the foundations were put in, but before they had begun to set, the strap for supporting the current transformer was inserted. As the cable projected above the finished foundation about 6 in., the transformer was placed directly above the cable ends. Four-wire connectors were used for connecting the transformer terminals to the cable terminals, and also for "jumping" the two terminals that were used in each post. These current transformers were manufactured by the Westinghouse Electric & Manufacturing Company, and designed for a maximum of 5500 volts. They are provided with reduced current taps, whereby 12 amp. may be obtained in the lamp circuit instead of 15 amp. The transformers have a ratio of two to one.

The fixtures used were the form 9 Novalux ornamental type with type E cast-iron casing. The globes are the No. 37 Monax. Both these items were supplied through the General Electric Company. The cable is made up with two No. 8 B & S gage, solid-copper con-



FIGS. 1, 2 AND 3—STEPS IN WIRING AN ORNAMENTAL LAMP POST BASE AS INSTALLED AT SHEBOYGAN, WIS.

In Fig. 1 the sidewalk is shown cut away with a hole in curb where the cable is pulled in from trench. The templet used to hold the lamp-post anchor rods is shown in Fig. 2. In Fig. 3 is shown the method of supporting the lamp transformer in the post base, and the method of connecting it.

FIG. 4—ORNAMENTAL STREET LIGHTING INSTALLATION IN SHEBOYGAN, WIS.

ductors with insulation suitable for 4000-volt service. It is protected by a lead sheath and two wrappings of steel 0.035 in. thick wound spirally in reverse directions, in addition to the usual amount of jute filling. The two wires are used for entirely separate circuits and are connected as shown in Fig. 5.

In the ordinance which authorizes the operation of the lamps, the City Council provided that one lamp at each street intersection and one lamp on the opposite side of the street in the middle of each block should burn all night, and that the remainder of the lamps should burn from sundown until midnight during the summer months and until 11.30 p. m. during the winter months. To provide for the control of the lamps in accordance with these requirements without the use of

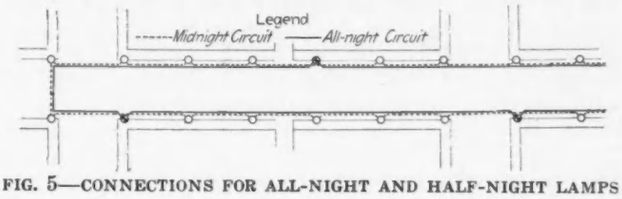


FIG. 5—CONNECTIONS FOR ALL-NIGHT AND HALF-NIGHT LAMPS

complicated equipment, the all-night circuit was arranged to be operated from one of the regular street lighting circuits, all of which are operated from dusk until dawn. For the lamps which are turned out at midnight a special regulator was installed, and all the lamps except those which were to burn the longer number of hours were connected through the current transformers to this circuit. As is shown in the accompanying diagram, the cable is installed in the form of an elongated U. In the base of each post one wire from the cable was connected directly to the corresponding wire in the next section, while the other wire was connected to the terminals of the transformer. This arrangement makes it possible to reconnect any lamp from the midnight circuit to the all-night circuit, or vice versa, by either "cutting in" or "cutting out" the transformer from the circuit desired. It has been found that the saloons which formerly had individual post lighting are desirous of maintaining midnight units on the all-night circuit, and the electric company allows this by the individual paying the difference between the rates for the two services.

After all of the transformers had been installed a crew of three men completed the erection of the posts, using a special platform ladder that permitted two men to have easy access to the top of the pole. All the material, which included the shaft, fixture, lamp and globe, was delivered to each post location by the company's truck. With these arrangements for distributing material, this crew of three men was able to erect sixty-eight complete posts in two days. The rapidity with which the work was carried on received very favorable comment from the public, and especially from the storekeepers fronting the streets on which the system was installed. The complete installation of the posts from the commencement of the work until its completion required only thirty-two days, although during one week nothing could be done on account of the inability of a manufacturer to make prompt shipment.

The electric company operates and maintains the midnight units for $37.50 a year each and the all-night units for $55 a year each. The illumination, while perhaps not comparable with that on many of the thoroughfares of the larger cities, is adequate for a town of 30,000 population. The light is well distributed and no shadows are noticeable even where the lamps are very close to the steel trolley poles. The cost of the system complete, not including overhead wiring or power station equipment, was $7,500, or a cost per unit of $67.

UP-TO-DATE LIGHTING IN A SMALL TEXAS TOWN

How the Freeport (Tex.) Light, Water & Ice Company Constructed and Installed Post Lights at a Cost of $8.50 Each

BY J. H. ROSS

The lighting system at Freeport, Tex., at the mouth of the historic Brazos River, the "Port of Destiny," has been in operation something over one year and makes this little town of fifty people one of the best lighted for its size in the Southwest. The installation consists of twenty 250-cp., 6.6-amp. series gas-filled lamps, and fourteen post lights consisting of two 110-volt, 60-watt Mazda lamps in series across 220-volt underground mains. The series lights are used for lighting the residence portion of the town and the post lights are installed in the business district. The lighting system is fed from the primaries of the Freeport Light, Water & Ice Company, which in turn, purchases power from the Freeport Sulphur Company. The street series lighting circuits are fed through a Westinghouse constant current transformer, of sufficient size to take care of future needs, delivering current at 6.6 amp. This transformer (and consequently the street lights) is controlled by a Campbell high-voltage time switch.

The post lights are fed from two General Electric type SL constant current transformers rated at 1 kw. each. One feeds a network of six and the other a network of eight pedestal lights. The current is taken from the street series circuit through protective devices similar to a film socket cutout, shown in Fig. 2, just to the left of the series lighting transformer. The transformers are located on the pole nearest the underground network they feed, the conduit being run up the pole to a point just below the transformer and the leads brought out through a type F condulet, as shown in Fig. 2.

The usual method of connecting the post lights in series was not carried out because it was desired to have the pedestal light circuit arranged so that it could be connected on the secondary distribution system, should the series circuit become inoperative for any

reason, for any length of time. The switch for this purpose can be seen in Fig. 2, on the lower crossarm between the transformer and end of the conduit line. Each post was connected in series-parallel and the secondary of the series lighting transformer connected in parallel and then the circuit from the SL transformer on the secondary side, so loaded as to give a voltage of 220 at the lamp, thus allowing two standard lamps to be used in series. Theoretically approximately a 3.33-amp. load should be carried at 220 volts with 6.6 amp. on the primary side, but experience showed that it was better to use a slightly heavier load and thus secure lower voltage with consequent longer life of lamps in the pedestal, since ample light was furnished at the lower voltage. This also would tend to eliminate excessive voltage should one pedestal light burn out while in operation. Ordinary 60-watt, 110-volt Mazda lamps were used, two to each standard. It was also found by experience that one post light being cut out had little effect on the voltage, there being not enough to burn out the remainder from excessive voltage, but where two posts on the same circuit were out the voltage began to rise sufficiently to materially shorten lamp life of remaining units.

The design of lighting standard is shown in Fig. 1, and is a strictly home-made product. It was essential that the standards be cheap and at the same time extra strong to withstand the gulf storms which often sweep the coast. They were made of 9-ft. lengths of 6-in. second-hand iron pipe secured from the Freeport Sulphur Company at the cost of cutting plus scrap value. The pipe was threaded on one end and a 6-in. to 2-in. reducer screwed on. Then a 2-in. close nipple was screwed in this reducer and the 2-in. fitter for holding the 12-in. C.R.I. ball screwed on to this nipple. The fitter was tapped on the inside for 0.75-in. pipe for holding the socket fitting. This was utilized as such and a 0.75-in. by 3-in. nipple screwed in, making a water-tight joint. Then the fitter was drilled at the lowest point to allow water when blown into it from the surface of the ball, to escape to the outside instead of going down the inside of the shaft. This made the shaft waterproof from above. A foundation of 2-3-5 concrete was made 18 in. deep by 36 in. square. Old 1-in. line pipe discarded for slight rust spots which made it unsafe to use in sulphur wells, was laid in a trench inside the curb line, from one pedestal to the next, extending in a continuous piece to within 6 in. of the top of the pedestal shaft. This made each wireway independent and easily accessible by removing the fitter on top of pedestal shaft. Iron wire was "fished in" at the same time for ease in installing the copper circuit. After this was done and before the concrete had time to "set" the 6-in. pedestal shaft was slipped over the 1-in. conduit lines and embedded in the concrete at the proper height above the sidewalk. It was lined up with a transit each way at the same time. After the foundation had set a concrete base, composed of one part cement and three parts sand, 18 in. square and 12 in. high, was placed thereon, and on top of this base was placed a smaller base 12 in. square and 10 in. high. The lower base is not shown in Fig. 1 because of the height of the sidewalk at that point. The smaller upper base only appears. The foundation came flush with the top of the sidewalk, making the base extend for a height of 22 in. above the sidewalk with the height of the post 9 ft. 6 in. over all.

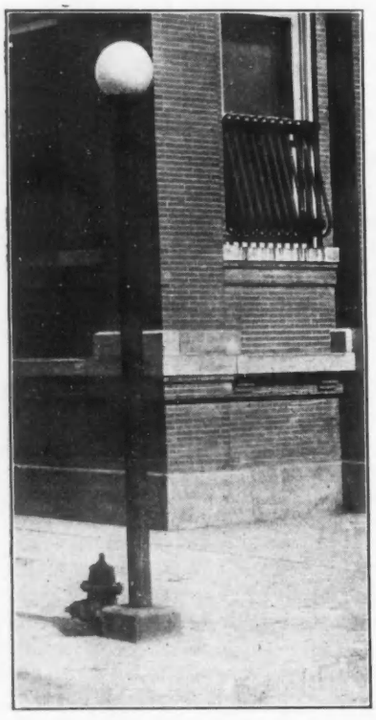


FIG. 1—HOMEMADE STANDARD

After the concrete was firmly set the copper wire was pulled in with the leading-in wire mentioned above. This wire was commercial, double braid, rubber covered, solid wire No. 14 new code. One reason for the 220 voltage used was to cut the size of this wire and still provide good distribution, since the distance from supply to farthest lamp was about 800 ft. It was thought at first that lead-covered wire would have to be used, but from the experience during the Aug. 16-19, 1915, West Indian hurricane, when water stood over the ground to a depth of 3 ft. for two days and absolutely no damage was done to any of the underground circuits such construction was considered safe. The post lighting system has given no trouble whatever other than the necessary maintenance of burned-out lamps and globes broken by mischievous boys. The entire maintenance has not been more than $1 per pedestal per year. Often no attention is given for months at a time other than to wind and set the time clock once per week. For a system from which no revenue is obtainable and much is expected in the way of light, it has proved to be entirely satisfactory both to the management and to the townspeople. It would lend itself most admirably to industrial lighting purposes.

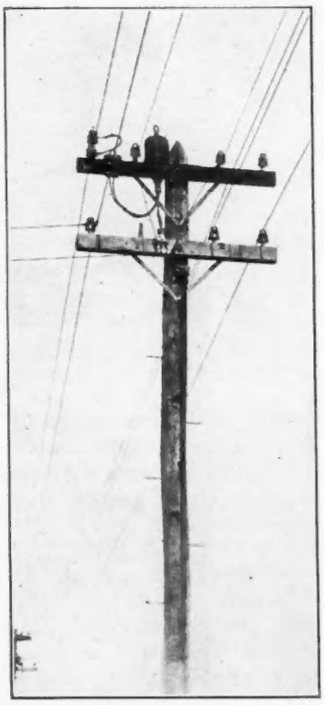


FIG. 2—POST LIGHT TRANSFORMER CUT-OUT IN STREET SERIES CIRCUIT

The resident lighting units consist of a Cutter porcelain body, Regent film socket, and 24-in. radial bowl reflector arranged for attaching a diffuser. The diffusers are not now attached on account of expense and lack of revenue from the lighting system. These lights are placed on poles set just within the curb line at each street intersection and at a height of 20 ft. above and 3 ft. out from the curb. They are supported by a 0.75-in. pipe gooseneck which is, in turn, partially supported by the feeder wires of No. 8 weatherproof copper from the two-pin standard arm at top of the pole. The main lighting and secondary leads are in the alley and break arms are used to "take off" the street lighting circuit at each intersection. The street lighting leads are kept above the secondary leads as much as possible.

The post described and shown in Fig. 1 cost approximately $8.50 each, complete, including the installation of conduit and wire.

Lighting That Combines Art and Science

High Standards of Interior Illumination Now Obtained by Proper Handling of Flux from Modern High-Efficiency Illuminants—A Review of Recent Developments in Indoor Lighting

BY DR. LOUIS BELL

THE present year has seen in progress some very sweeping changes in the material and technique of lighting, and particularly in interior lighting—changes which from the standpoint of the illuminating engineer are very hopeful as showing at least the beginning of broader methods of dealing with the subject. For the last two or three years the whole subject of interior lighting has been in a peculiarly unsatisfactory state, owing to the rapid changes which have been going on in lamp manufacture. When the metallic filament lamps first became fairly common the illuminating engineer had to face conditions of the most exasperating sort in trying to adapt the new illuminant to old fixtures. As a rule, the new lamps did not fit the old shades either mechanically or optically, with the result that the introduction of the metallic filament lamp brought, when carried out by the average user, some of the most abominable lighting in the history of the art. Even now 100-watt tungsten lamps are to be seen thrust into rather flat, so-called distributing shades, intended originally for 32-cp. carbon lamps, and there are other equally bad misfit combinations of the old with the new.

The worst of that trying period is now over, although there are still complications coming along with the Type C lamp with its greatly increased brilliancy and concentrated filament. Shades meant for the Type B lamps generally are not well suited to the later form, and when the capacity of the latter shall have been reduced so that it can be used more freely in interior lighting even than now, the same troubles are bound to recur. As the intrinsic brilliancy of the filament rises it becomes progressively difficult properly to shield it, so that it will not fairly hit one in the eye, and before the illuminating engineer feels really comfortable about the latest lamp there will have to be still further modifications of the inclosing shades. However, the good work has already been begun and the makers of glassware have, rather slowly, risen to meet the situation. Perhaps their deliberation has been justified in great measure by the fact that it is almost impossible to determine what bulb and filament dimensions are likely to turn up in the next three months.

The greatest measure of help to the illuminating engineer has come through the gradual realization that, given a brilliant and efficient source of light, the illumination to be derived from it may be obtained in either through, under, or over a proper screening medium in many different ways, while still reaching the desired result. There was a time when the struggle between so-called direct, indirect and semi-direct or semi-indirect systems, partook somewhat of the spirit which once existed in the direct and alternating-current field. The competent engineer now realizes fully that there is no one best method or device for shielding lamps from the eyes and distributing their light where it will do the most good. He must be ready at all times not to exploit a system, but to give in each case the results best suited to the conditions set before him. There is no field of engineering in which there is a finer opportunity for originality and initiative in securing results than in illumination. It is a pleasure to regard the fact that the makers of illuminating devices are appreciating the situation and coming to the help of the lighting engineer.

THE LIGHTING OF THE ROTUNDA AND LIBRARY OF NEW YORK STATE'S NEW EDUCATIONAL BUILDING AT ALBANY

In the library reading room, pictured at the right, the general illumination is furnished by indirect sources, while reflector troughs are used to light the readers' tables and the book shelves. In the equipment of the great central fixture of the rotunda, shown at the left, a novelty has been introduced in the form of vacuum tubes which parallel the suspension members, giving the appearance of support of the great lantern by a band of light.

The most unsatisfactory remaining feature of the situation is the tendency of dealers to exploit, with more zeal than discrimination, certain lines commercially desirable for themselves. As a matter of fact, there are so many good fixtures available at the present time that there is no excuse for bad and inartistic results if reasonable care is exercised in selection. One can find direct, indirect or semi-indirect fixtures which will enable him to meet almost any given set of conditions excellently well if he but chooses the right kind of fixture and the right form for the requirements at hand.

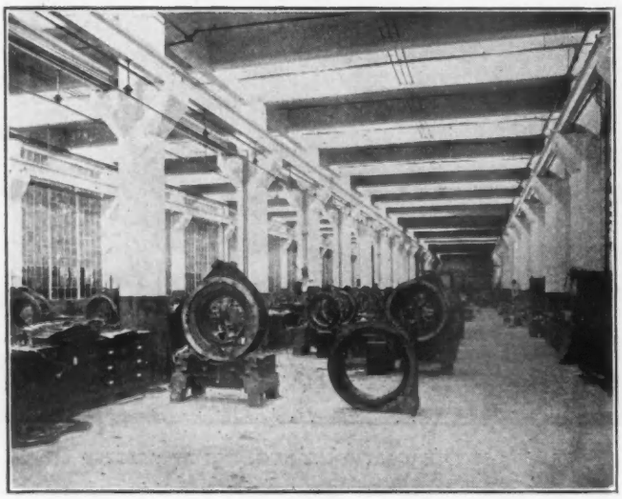
Perhaps the most striking developments have been in the way of semi-indirect units, chiefly for the reason that this particular type of fixture gives the widest opportunity for well-chosen variations in effect. Two or three years ago it was difficult to obtain a globe which gave good diffusion without too great opacity. At present results have been achieved a little short of marvelous. Moreover, there is choice enough to enable the illuminating engineer to get almost any results he desires, provided he studies his conditions carefully. This cannot be done by any cut and dried rule, or by the use of any especial type of fixture. Half a dozen kinds of globes or bowls using the same lamp may and commonly do vary greatly in their adaptability, while all give the required lumens on the working plane. Certain types, for example, work beautifully in spaces which are large and light in tone, while from too great contrast they may fail miserably in contracted spaces or with dark surroundings. The maximum intrinsic brilliancy permissible is not a constant, but is a variable with respect to the contrasts which the eye has to meet, a fact which has been responsible for not a little bad lighting. This consideration applies alike to all schemes for light distribution.

To pass from the general to the concrete, the tendency with modern high-power lamps has of late been in the direction of indirect and specially semi-indirect fixtures. The introduction of the Type C lamp sent many of the earlier forms of these fixtures to the scrap heap because of too great brilliancy, bad distribution or the production of streaks, spots, and hard shadows in the lighting. These difficulties have in great measure been met at the present time, very largely through the improvements introduced in the last year or so. Considerable yet remains to be done, however, before it becomes easy to obtain satisfactory results from the artistic standpoint. The fact that the Type C lamp is almost a point radiant makes it exceedingly sensitive to changes in position and very difficult to shift readily from one size to another with certainty of good effect. The engineer does not always want to tie himself to a particular specified size of lamp with a particular specified size of glassware, for the reason already suggested, and in many cases finds it not easy to adjust lamp and fixture without a proper series of standardized adapters so that the radiant point shall come at exactly the right spot to give, through or over the glassware, precisely the right effect. Sometimes a change in position of an inch in the filament will make all the difference between success and failure from the artistic standpoint. These are the things that must be attended to in the steady progression of the Type C lamps in interior practice.

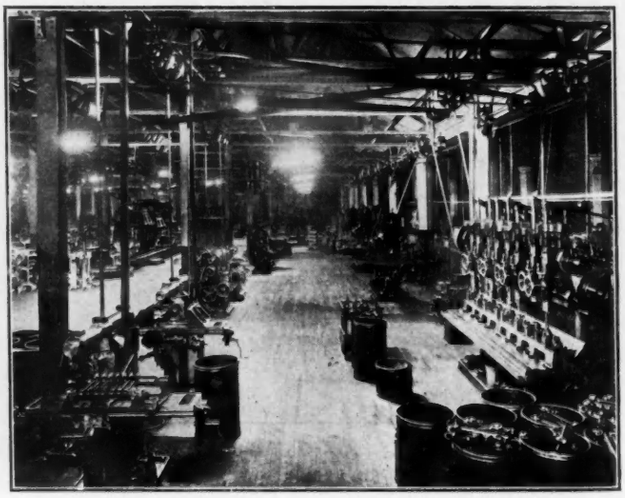
That this lamp will be generally available in fairly small units seems now evident, although how far it will show advantages in this minor rôle remains to be determined. It gives a peculiarly concentrated white source of light very desirable for certain purposes, less so for others, but the bulb runs at a very high temperature, which is not infrequently a disadvantage. The limitations of its efficiency and its practical use constitute one of the important problems in the immediate future. When this is fairly well settled the way will be opened for a very great improvement in fixtures from the artistic standpoint.

The metallic filament lamp, whether vacuum or gas-filled, has for the first time given to the art a source so efficient that it is feasible economically to enter into the studies of artistic effect which were generally quite out of the question in the early days of electric lighting. The first electric fixtures followed closely on the pattern of gas fixtures, and these in their turn had proceeded along the lines of the fixtures for candles and oil lamps which had been worked out by the craftsmen of the seventeenth and eighteenth centuries. Anyone who glances over D'Allemagne's "Histoire des Luminaires" will recognize readily the source from which many beautiful recent fixtures have been drawn. Such fixtures were often not only artistic, but considering, the lamps with which they were to be used, fairly efficient.

To-day it is possible, without unreasonable expense, to use fixture designs in which for obtaining beautiful results something of efficiency is deliberately sacrificed. If the writer mistakes not we are likely to have an evolution of highly artistic fixtures following not the precedent of the candelabrum of two centuries back, but a new art particularly adapted to modern light sources. Signs of this change are already evident. Designers are feeling about, sometimes, it is true, in crude and ineffective ways, for new lines of expression in terms of light. This evolution should be heartily encouraged, for it is likely before long to produce a very profound im-



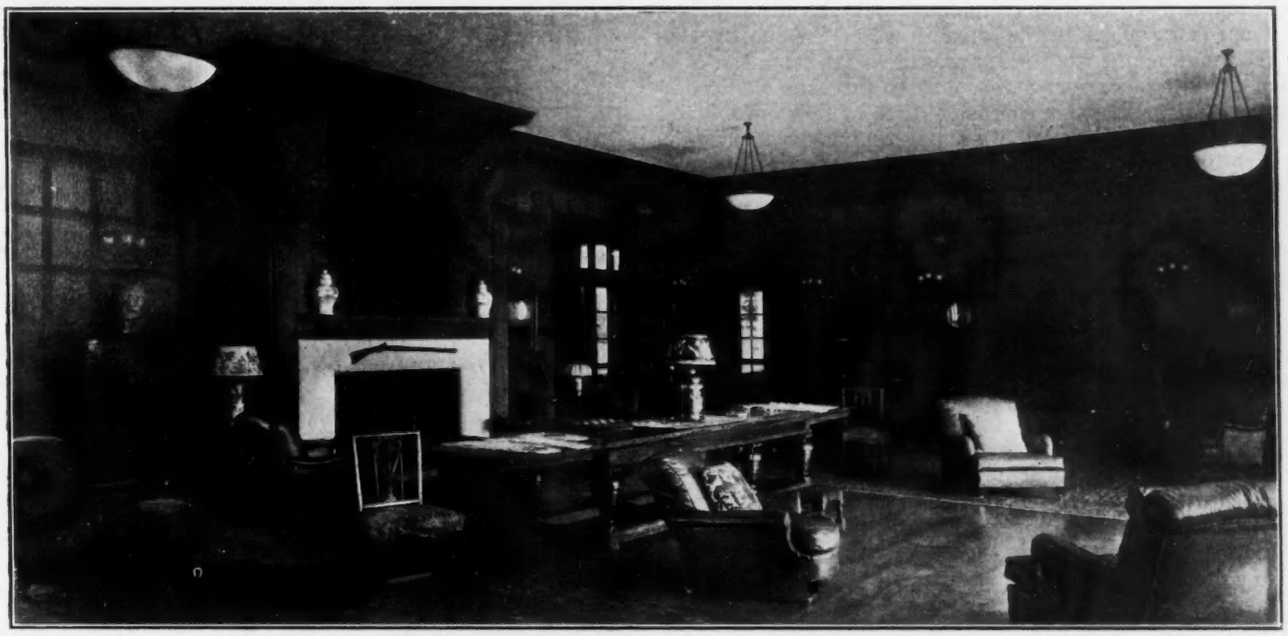
TROUGH LIGHTING IN A FACTORY ASSEMBLING ROOM



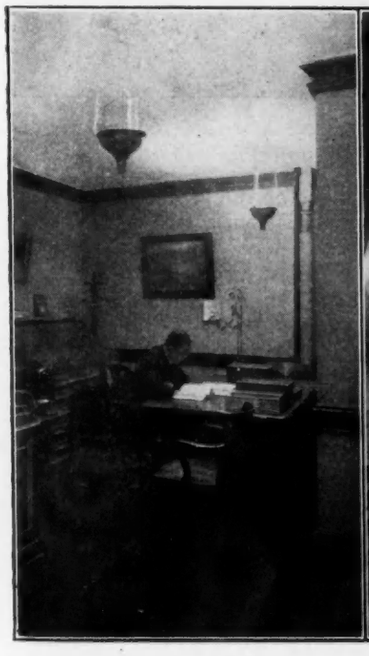
MERCURY-ARC ILLUMINATION OF A MACHINE SHOP

GOOD LIGHTING IS OF PRIME IMPORTANCE IN ATTRACTING BUSINESS TO THE RETAIL STORE

AN ATTRACTIVE INTERIOR MAY BE SHOWN OFF TO ADVANTAGE BY SEMI-INDIRECT LIGHTING

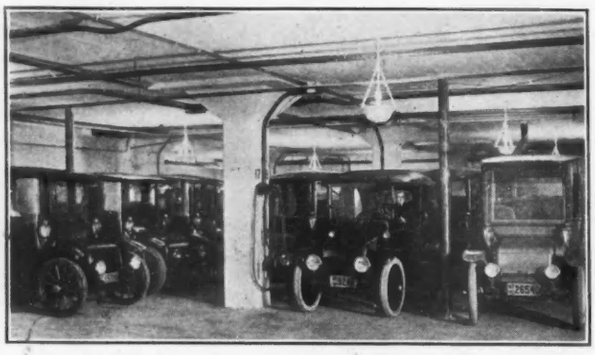


LIVING ROOM OF A FINE COUNTRY HOME LIGHTED BY SEMI-INDIRECT FIXTURES, SHADED WALL UNITS, AND TABLE LAMPS



AN INDIRECT-LIGHTED OFFICE

THE CLASSICAL IN LIGHTING FIXTURES IN A LEADING METROPOLITAN HOTEL

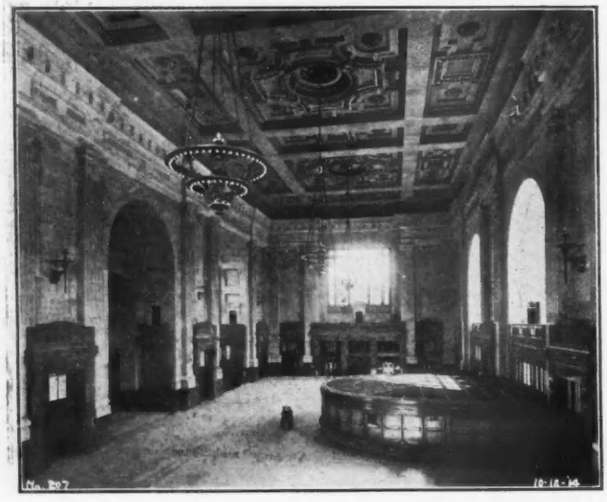


SEMI-INDIRECT FIXTURES IN A GARAGE

pression. In this connection the question of color is especially important. The carbon incandescent lamp perpetuated the tone of the candle and oil lamp which preceded it. The metallic filament lamps, although far from being white in the sense in which the spectroscopist would define the term, are still so far from the color of their predecessors as not only to threaten old decorative effects, but to open possibilities of new ones.

There is an undeniable call for toning down, particularly in domestic lighting, the rather cold and hard color of the present incandescents, and interesting experiments are being tried with lamps either coated or provided with slightly tinted globes to effect this result. Such a change means, of course, a loss in efficiency, but one which at times can be well afforded, considering the efficiency of the sources with which we start. The same result can be achieved by the toning of glassware and of diffusing surfaces in general. If one were to bear in mind the general decorative effect of an interior, and then allow himself the luxury of lighting it so as to enhance and not to diminish this effect, some very striking results could be achieved, as they probably will be ere long. On the other hand, for some industrial purposes it is desirable to proceed in a totally different direction, either to modify the color of the existing source so as to give a closer approximation to daylight or even to go to the extent of so changing the color as to give especial ease in discriminating certain things in which color is a considerable factor. For instance, to use a single example, it is well known that the mercury arc has shown particular adaptability to certain classes of metal working by rendering strikingly evident blemishes otherwise relatively inconspicuous. Thus, too, in the photographic atelier color-toned lamps are occasionally very useful adjuncts. This field is just being opened to investigation and is deserving of intensive cultivation. The more the illuminating engineer concentrates his mind on the fact that illumination is the thing to be furnished, and not merely a certain amount of luminous energy, the nearer he will come to meeting the full requirements of his art.

The day of selling "juice" for lighting purposes, although not quite past, is fortunately fading. The work of the illuminating engineer, so far from being gradually standardized by the adoption of new commercial "units" and rule-of-thumb methods, is just beginning to reach out after a finer technique and effects commensurate with the technological advance in the methods of producing his raw material, light.



HUGE CENTRAL FIXTURES THAT DOMINATE THE GREAT WAITING ROOM IN THE NEW KANSAS CITY RAILROAD STATION

Flame Arc and Incandescent Post Installations Operated in Indianapolis, Ind.

During the early part of 1915 the Merchants Heat & Light Company of Indianapolis, Ind., remodeled the city flame arc and incandescent lighting systems and made extensions which called for the replacement of all open-flame arcs and the installation of about 1000 gas-filled incandescent lamps. There are now operated throughout the city 2777 Westinghouse 10-amp. inclosed-flame arcs and 1181 10-amp. incandescent units.

TYPE OF ARC LAMP INSTALLATION AND ORNAMENTAL STANDARDS USED IN INDIANAPOLIS, IND.

The accompanying illustration shows the type of ornamental post lighting now used on boulevards and in the parks. At the left in the halftone is also shown the standard street pole used for the flame arcs. The annual load represented by the present Indianapolis system is 6,397,168 kw.-hr. operated at the following rates: arcs, $41.98 per lamp per year, and incandescents, $27.71 per lamp per year. According to R. A. MacGregor, sales manager of the Merchants Heat & Light Company, the new system has proved entirely satisfactory and provides better illumination at a smaller operating cost than the former system. The rates for the old system were: $73.44 per lamp per year for arcs and $34.80 per lamp per year for incandescent units.

An Improved Form of Street Lighting Contract

Features of Indeterminate Form of Agreement Which Provides Low Cost to Municipality by Eliminating Risks to Operating Company

CONTRACTS between cities and public service corporations have so often been the occasion of distrust and suspicion between the parties thereto, and have so often been judged on the basis of political issues rather than as business arrangements, that the development of a new form of contract designed to avoid many of the difficulties of the past, is of considerable importance. Such a contract has been developed and applied to street lighting in a number of agreements entered into between operating subsidiaries of The Wisconsin Edison Company and municipalities in the Milwaukee district. This form of contract was made possible by an amendment to the Wisconsin statutes enacted in the year 1915.

There has been a growing adverse feeling upon the part of municipalities toward entering into long term contracts for street lighting service. Voluntary reduction in rates for commercial service and advertised changes in the art of street lighting have resulted in the expectation that negotiations a few years hence would result in cheaper terms. The street lighting issue has also, in many places, made good political propaganda and there have accordingly been powerful interests adverse to settlement. Contracts between public service utilities and municipalities have accordingly often been entered into in a spirit of mutual distrust. Short-term contracts and constant changes in requirements as to methods and extent of illumination have, through the large hazard they have brought about, resulted in rates higher than otherwise necessary.

INTERESTS AFFECTED BY STREET LIGHTING CONTRACT

The interests to be recognized in drafting the most equitable and economical form of contract are as follows:

1. The interest of the city lies in a contract which will permit it to negotiate for the desired service whenever there is a real or fancied improvement in design or style of street lighting service; or whenever the advance in the art or the increase in the electrical saturation of the territory served, decreases the cost of rendering the service.

2. The interest of the utility lies in a contract which will permit it, from the revenues received, to meet operating expenses and fixed charges, and to write off, during the term of the contract, such investment as has been made in order to enter into the contract and which is not useful elsewhere in the utility's business.

A utility entering upon a street lighting contract is under the necessity of acquiring and installing certain physical property in order to perform a specified service. Some of this equipment, as for instance additions to the boiler plant, is of such a nature that upon the termination of the street lighting contract it may be taken over and used for other business of the utility. This is subject to two conditions: (a) that the earnings have been sufficient to maintain the property and to set up a reserve against the accrued depreciation, and (b) that the company's business is such as to warrant the taking over of this property. Other items such as lamps and special supports are of no value except as they may be sold as second-hand equipment or as junk. The utility therefore finds it necessary to include in the costs on which the street lighting rate is based, some allowance for the amortization, during the life of the contract, of that part of the investment made for the purpose of entering into the contract, but this has no value when it is terminated. The advantage of a contract of definite life is assumed to lie with the city which is enabled to undertake negotiations for renewal on the basis of cheapened and more efficient processes which may have been developed during the life of the contract. It is evident, however, that this advantage cannot be dissociated from the economic loss accruing through the discarding of equipment still possessing some useful life but valueless except in connection with the service rendered according to the contract under which it was installed. Under these circumstances the element of chance plays an important part in the usual definite term street lighting contract, and to eliminate the hazards for both the utility and the city, and to provide at the same time sufficient flexibility to insure such changes in the service as the city desires from time to time, the indeterminate contract has been evolved.

The usual agreement entered into between a lighting utility and a city for the lighting of streets by the utility, consists essentially of two parts: (a) the service to be performed by the utility, and (b) the payment to be made therefor by the city. These two basic provisions may be covered by a large number of sections giving details and providing, among other things, for the superseding of existing contracts, the termination of this contract, the extent and character of service, the conditions of departure from standards specified, the rates of charge for street lighting, the method of paying the utility, including the method of settling disputes, and the liability of the parties for accident and damage.

HOW NEW CONTRACT DIFFERS FROM USUAL FORM

The new type of contract differs only in its provision for the termination of the contract and the manner in which rates are stated. As to the provision for the termination of the contract, the new form differs from the usual form in that no date of expiration is fixed. Instead it is provided that the utility shall furnish electric street lighting service for an indeterminate term continuing from the date of the contract until terminated by the city. The city is required to give due notice of its desire to terminate the contract and to recompense the utility for all unamortized investment in special street lighting equipment.

The rates of charge are based on the cost of service, and the elements of cost are set forth in the contract. It is provided first, that the rate per lamp per year shall be the sum of four component factors; second, that these factors shall be re-computed from time to time; and third, that the utility shall set up and maintain a depreciation reserve in connection with its investment in special street lighting equipment.

FACTORS AFFECTING LIGHTING RATE

The rates for the first year are specified in the contract. A typical rate schedule indicating the four factors affecting the rate is shown in Table I on page 472.

The following equation indicates the relation of the several factors to the rate:

N = Number of lamps.

D = Rate per lamp, per year, dollars.

A_1 = Fixed charges on joint investment per lamp, dollars.
A_2 = Joint operating expenses per lamp, dollars.
B = Fixed charges on special lighting investment per lamp, dollars.
C = Direct operating expenses of street lighting per lamp, dollars.
I_j = Investment per lamp—joint, dollars.
I_e = Investment per lamp—special, dollars.
i = Interest rate in investment, per cent.
t = Tax rate, per cent.
d = Depreciation rate, per cent.
s = Insurance rate, per cent.

$$D = A_1 + A_2 + B + C.$$
$$A_1 = (i + t + d + s)\ I_j.$$
$$B = (i + t + d + s)\ I_e.$$
$$D = (i + t + d + s)\ \ (I_j + I_e) + A_2 + C.$$

Note:—Different values of all amounts represented by capital letters will be found for service rendered by each type of lamp.

The costs listed in column "A" consist of fixed charges providing for the elements of cost represented by insurance, taxes, depreciation (replacement insurance), and interest upon the investment of the utility, jointly used for street lighting and other public service. This investment includes power plants, substations, transmission and distribution systems, and such apparatus, fixtures and appliances as are appurtenant thereto. Joint operating expenses include cost of power generated or purchased and the cost of its transmission, transformation, and distribution, together with the general expenses of administration and supervision jointly incurred for street lighting and other services.

TABLE I—FOUR FACTORS OF TYPICAL RATE SCHEDULE

Type of Lamp	A		B	C	D	Service
	Fixed Charges on Joint Investment	Joint Operating Expenses	Fixed Charges on Special Street Lighting Investment	Direct Operating Expenses of Street Lighting	Total Rate Dollars per Lamp per Year	
4 ampere magnetite overhead distribution	$15.00	$14.50	$14.00	$10.50	$54.00	All night
	15.00	9.50	14.00	7.00	45.50	Midnight
4 ampere magnetite underground distribution	31.00	15.00	22.50	10.50	79.00	All night
	31.00	10.00	22.50	7.00	70.50	Midnight

NOTE:—The prices shown here are not those actually appearing in existing contracts and are inserted for the purpose of illustration only.

The costs listed in column "B" are made up of fixed charges consisting of insurance, taxes, depreciation (replacement insurance), and interest upon the investment of the utility exclusively used for street lighting service. This investment comprises the lamps, brackets and supports, including special poles, special station equipment and distributing and connecting lines or circuits devoted exclusively to street lighting service.

The contract sets forth the agreed amount of the special investment devoted to street lighting service at the beginning of the operation of the contract and that there has been set up a reserve to insure the replacement of such special investment. It is further stipulated that the fixed charges, computed upon a unit basis per lamp per year, consist of certain percentages to insure replacement, to cover taxes, interest and insurance. The utility agrees to account separately for the special investment, making additions thereto from time to time where added special investment is required by order of the city under the contract, and deductions therefrom from time to time where special investment no longer used and useful has been retired from service. The utility further agrees to account for the reserve accumulated to insure replacement (depreciation reserve), making additions thereto from time to time from that part of the fixed charges representing replacement insurance, and an addition of interest at a fixed rate per cent per annum, to be credited to the reserve on specified dates, and to be computed upon the reserve on hand on these dates, and deductions therefrom from time to time equal to the cost of special investment no longer used and useful and retired from service. The fixed charges computed upon a unit basis per lamp per year are to be revised annually by calculating the fixed charges on the investment at the end of the year.

The costs listed in column "C" are made up of direct operating expenses of street lighting, consisting of cleaning and trimming lamps, maintenance of street lighting circuits and other special equipment, lamp repairs, renewal of globes, renewal of electrodes, rectifier tube renewals, and such other operating costs directly incurred in the operation and maintenance of the special investment devoted to street lighting service.

The contract further provides that the utility shall separately account for such costs of operating the special street lighting investment, and this part of the cost shall be revised at the end of each contract year to conform to the actual costs for the contract year then expired, and such revisions are to be applied to the rates for the ensuing year.

In order that the city may be advised at all times as to the basis of computing rates, and as to its obligation in the event that it desires to terminate the agreement, the utility agrees to submit annually, at the completion of each contract year, a statement of account of the special investment in street lighting equipment; a statement of reserve accumulated to insure the replacement of such investment; a statement of the cost incurred during the year in the operation of the special investment devoted to street lighting service, and a statement of the resulting adjustment in rates for the succeeding year.

As previously pointed out, the city may terminate the contract at any time upon due notice to the utility. The exercise of this right carries with it a certain obligation, as the city agrees that upon termination of the contract it shall promptly pay the utility the difference between the special investment in street lighting equipment and the depreciation reserve accumulated to insure the replacement of such equipment as accounted for by the utility at the date of termination of this contract.

The wording of the contract is unusually clear, and while the provisions appear at the first to be complex they are readily understood, and the working out of the provisions may be grasped by all interested parties. Some special accounting is required by the utility, but this presents no difficulties when the customary accounting and plant records are available. Some comments as to the method of determining the initial rate for the first year of service may, however, prove of interest.

DETERMINING INVESTMENT JOINTLY USED FOR STREET LIGHTING AND OTHER SERVICE

The first step in arriving at the rate consists in determining the investment of the utility jointly used for street lighting and other service. This should be set out by classes of property, and for each class the amount of the investment properly chargeable to street lighting should be shown. Next, proper values of depreciation, insurance, tax and interest rates are to be determined. From these data the fixed charges on joint investment, column "A," can be calculated.

The next step is to determine the proper part of

joint operating expenses to charge to the particular service under consideration. Some difficulty may be encountered in apportioning the value of certain pieces of property, jointly used, as between street lighting and other services, and in determining the part of certain joint operating expenses properly chargeable to any one service, but an analysis of the problem usually discloses a situation much less complex than anticipated, and suggests an equitable basis of apportionment. The items in columns "B" and "C" will present no difficulty, and can be obtained in large part directly from company records.

Fixed Charges on Special Street Lighting Equipment

Since the contract imposes certain obligations upon the city with respect to the utility's investment in special street lighting equipment, the following tables deal only with this investment. The treatment of investment in jointly operated property is similar.

TABLE II.—METHOD OF COMPUTING FIXED CHARGES ON SPECIAL STREET LIGHTING INVESTMENT

Amount of property wholly chargeable to street lighting		$175,000.00
Depreciation accrued to Jan. 1, 1916		40,000.00
Fixed charges for first year, "*B*":		
Interest	7 per cent	
Taxes	1½ per cent	
Depreciation	6 per cent	
Insurance	½ per cent	
	15 per cent	
$175,000 at 15 per cent		$26,250.00
Charges for 1500 lamps, per lamp		17.50

Table II shows the method of computing fixed charges on special street lighting investment ("B"), as included in the rate for the first year. It is assumed that, during the first year, there will be added $5,000 of additional equipment and $10,000 of existing equipment will be replaced. On Jan. 1, 1917, the account will appear as follows:

TABLE III.—METHOD OF COMPUTING FIXED CHARGES ON ADDITIONAL AND REPLACED STREET LIGHTING INVESTMENT

January 1, 1917.	
Amount of special street lighting investment Jan. 1, 1916	$175,000
Additions to January 1, 1917	5,000
	$180,000
Depreciation accrued to Jan. 1, 1916	$40,000
Depreciation accrued Jan. 1, 1916, to Jan. 1, 1917	10,500
Interest on depreciation reserve during 1916	1,200
Total depreciation reserve credits	$51,700
Charges to depreciation reserve for replacements	10,000
Amount of depreciation reserve Jan. 1, 1917	$41,700

Fixed charges for second year, "*B*"
15 per cent on $180,000 = $27,000
1600 lamps, per lamp = $16.88

During the following year no additions were made and only $2,000 of renewals made and charged to depreciation reserve. For 1918 the fixed charges on special lighting investment are determined, as shown in Table IV.

TABLE IV—FIXED CHARGES AS COMPUTED FOR SECOND YEAR

January 1, 1918.	
Amount of special street lighting investment Jan. 1, 1916	$175,000
Added during 1916	5,000
Added during 1917	....
	$180,000
Depreciation reserve Jan. 1, 1917	$41,700
Depreciation credited to reserve during 1917	10,800
Interest on reserve credited during 1917	1,257
Total credits to depreciation reserve	$53,757
Renewals charged to depreciation reserve, 1917	2,000
Amount of depreciation reserve Jan. 1, 1918	$51,757

Fixed charges for third year, "*B*,"
15 per cent on $180,000 = $27,000
1600 lamps, per lamp = $16.88

In making charges to the depreciation reserve for renewals, net amounts are used; that is, the cost of material, plus labor, less any credit for scrap.

One of the important features of this type of contract is the distinction automatically made between the charge for a lamp added on an existing circuit and one added on an extension. In the former case the only investment required is in the lamp itself, while in the latter there is the additional investment necessary to extend the circuit. Doubling the number of lamps on existing circuits would increase the amount of special street lighting investment by $96,000 and reduce the fixed charges per lamp included in item "B" from $17.50 to $13.55. Other elements of cost would also be affected with the increased density.

Increase in Costs Due to Underground System

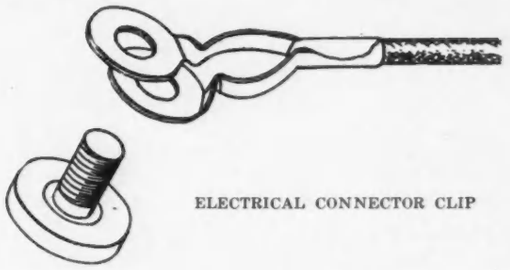
The effect of requiring the utility to place the distribution system underground is, as shown in Table I, to double fixed charges on joint investment, and to increase by one-half the fixed charges on special street lighting investment. Joint operating expenses are increased slightly and direct operating expenses not at all. The result of requiring an underground distribution system is thus to increase the cost per lamp about 50 per cent. On the other hand if it is desired that the lamps shall burn all night instead of to midnight only, the increase in cost is only 10 per cent, and lies entirely in 50 per cent increase in operating expenses.

The provision for revision of rates from year to year permits the city to share in any lowering of costs due to invention, improved load factor, or other operating condition.

There are many obvious advantages to be derived from the indeterminate form of contract, but not the least of these is that it reveals, as does no other form, the necessary relation between rates and costs, and while permitting the municipality to have any kind of street lighting it desires, still guarantees the utility against loss from investment in equipment rendered useless by a change in the style of lighting desired by the city. The removal of mystery as to the basis of computing rates and the establishment of a definite figure at which the city can terminate the contract are alike advances away from the suspicion and distrust which have so often characterized municipal contracts in the past. The mechanism of the contract provides in brief all the advantages of a rate determined in accordance with accepted principles of rate regulation.

Electrical Connector

A novel and suggestive electrical connector has been made the subject of patent No. 1,195,079, by Johann G. Peterson of Jersey City, who has assigned it to the Manhattan Electrical Supply Company of New York. The clip has been specially designed for battery work. By providing spring arms with apertured plates there is



ELECTRICAL CONNECTOR CLIP

a tendency to insure contact by a shearing action, even though the fastening nut should work loose.

For laboratory work where quick though rough and ready connections are a desideratum, it would seem that there might be some advantage in providing two spring arms on one side to oppose the single spring arm on the other. By gripping the bowed arms between the fingers a quick alignment of holes is made possible.

COMBINED TROLLEY POLE AND ORNAMENTAL POST INSTALLATION

Features of the Street Lighting at Sandusky, Ohio, Including Details on Distribution System and Lamp Equipment

About a year ago the street lighting installation of Sandusky, Ohio, was remodeled and a new ornamental system installed in the business district. Series inclosed alternating-current 7.5-amp. arcs were also replaced in the residental districts by Mazda type C units of 60, 100 and 250 cp. installed in bracket fixtures on wood poles. Some 225 arcs were replaced and 1350 incandescent units installed. The accompanying illustrations show the character of the installation in the business district which employs a combination trolley pole and ornamental standard.

Installation in Business District

This installation consists of 190 ornamental standards, spaced about 55 ft. on each side of the street, with lamps opposite each other. Each standard carries two 250-cp. Mazda C, 7.5-amp. series lamps in 14-in. globes. In the business district sixty-seven of the standards encase trolley poles for support of the trolley span wires. The installation is divided into three circuits, two of which (seventy-four posts each) burn until 11 p. m., and one, consisting of forty-two posts, burns all night.

All of the lamp circuits are No. 8 duplex, 30 per cent Para insulation steel taped cable run from lamp to lamp in the sand cushion between the brick surface and the concrete base of the paving. No. 10 single conductor, 6/32-in. 30 per cent Para braided cable is used in the posts, and No. 8 single conductor, 5/32-in 30 per cent Para lead cable is used for street crossings and for connections between the subway system manholes and the lighting system, run in 3-in. fiber conduit encased in concrete.

The cable splices are all made in the base of the standard and no cutouts are used in the bases. One conductor of the duplex cable is used for the all-night circuit and the other for the half-night circuit. Both circuits are brought into each lamp base, the one not

FIG. 1—NIGHT ILLUMINATION IN THE BUSINESS DISTRICT OF SANDUSKY, OHIO

used for any lamp being spliced straight through. The series cutouts are placed in the manholes of the subway system so that each half-night circuit can be sectionalized into five and the all-night circuit into ten loops.

Standard General Electric receptacles and sockets are used, the No. 25,712 receptacle being mounted on lugs cast in the hood. This hood has a ventilating ring furnished by the manufacturer which gives all the ventilation necessary without the use of a ventilating globe. The posts are of the built-up type, manufactured by the Union Metal Manufacturing Company, Canton, Ohio, and are set on a concrete base measuring 2 ft. long by 2 ft. wide by 2 ft. thick, the anchor rods being embedded in the base.

Installation in Residential District

The residential installation consists of 916 100-cp., forty-seven 60-cp. and five 250-cp. Mazda C 7.5-amp. series lamps, mounted on wooden poles using General Electric series bracket No. 160,224, with 20-in. radial

FIG. 2—COMBINATION TROLLEY AND ORNAMENTAL LIGHTING STANDARDS USED IN SANDUSKY, OHIO

wave reflector. Porcelain strain insulators are used, at each lamp, and lamp connection is made by means of No. 8 duplex cable, each conductor insulated for 600 volts and 10,000 volts to ground. This cable is run down the pole on glass insulators, using Marlin ties, and is concealed in the fixture from pole to lamp.

Lamps are divided into four circuits, all circuits being two-wire No. 6 weatherproof copper, avoiding all belt line circuits. The lamp spacing varies in different sections. Some streets have about 100-ft. spacing, other one lamp on each corner and one in the center of the block. The outlying districts have only corner lamps. The lamps are spaced so that the center of the filament is 15 ft. above the surface of the roadway. Special brackets 6 ft. in length are used at corners and are placed at an angle of 45 deg. to the curb lines, so as to light both streets at the intersection.

These fixtures are connected with the overhead distribution circuits by duplex conductor which gives a neater appearance than two single conductors.

The rates charged for the system are as follows: For the ornamental system using 250-cp. lamps on all-night schedule, $32.50 per year; for this installation on half-night schedule, $21 per year. For the residential system, using 250-cp. lamps on brackets, the rate is $27 per year; for the 100-cp. lamps, $16 per year, and for the 60-cp. lamps, $13 per year. E. A. Beckstein, manager of the Sandusky (Ohio) Gas & Electric Company, reports that the new system is a great improvement over the old conditions, for which a rate of $50 per lamp per year was made.

Tendencies in Street Lighting Practice

Reports from More than 100 Cities Giving Features of Present Street Lighting Equipments with Rates, Cost of Installation and Maintenance

THE tendencies in street lighting practice, and the rates for various kinds of service are indicated by the accompanying data for more than 100 cities ranging from metropolitan population down to 25,000 inhabitants. The information has been compiled from reports received recently from different companies furnishing street lighting service and from other reliable sources. The data is arranged in the order of the population of the cities so that studies of installations in towns of similar size can be readily made. In connection with this information rates, character of service (all night, half-night, underground and overhead) and annual kw.-hr. consumption are given in many cases.

A study of the tables will show that practically all types of street illuminants formerly used are giving place to gas-filled incandescent lamps and the improved types of arc lamps. Although gas-filled lamps are very prominent among the recent installations the number of magnetite arc lamps which have also been recently installed is by no means small. This is probably due to the fact that longer life electrodes are now being furnished which partly compensates for the handicap that this type of lamp suffers in competition with gas-filled units. At the same time there is evidence that increased confidence is being placed in gas-filled lamps, this being probably due to the increased lamp life which can be obtained, due to improved methods of manufacture and improved forms of fixtures.

LIGHTING LOAD AND RATES

It is interesting to note that while higher efficiency lamps have been substituted for lesser efficient types the total load, in many cases, has seldom been reduced and has sometimes even been increased, due to substituting several of the newer types for each unit of the older equipment. While the general practice is to continue the flat rate system of charging for street lighting service, a few companies are charging on the energy consumption basis. Under such conditions, or when an exceptionally low flat rate is offered, some of the companies only furnish and maintain the distribution system and supply the energy while the lamps are maintained by the city. In one case the street lighting is furnished on a sliding scale basis. According to the reports, about 15 per cent more is charged for underground service per year with Mazda C lamps than for overhead service, and about 24 per cent more for underground service than overhead with magnetite lamps. About 37 to 42 per cent more is charged for all-night service than for half night. The 400-cp. and 600-cp. gas-filled lamps seem to be the most popular sizes, although units rated as high as 1000-cp. and 750 watts are used under some conditions in Cambridge and Taunton, Mass.; Wilmington, Del.; Pasadena, Cal.; Evansville, Ind.; Brooklyn, N. Y.; Cleveland, Ohio, and other cities. The average rates for all-night service, disregarding type of distribution, fixtures, etc., with 100-cp., 250-cp., 400-cp., 600-cp. and 1000-cp. gas-filled lamps, are about in the ratio of 19:37:50:60:72.

According to reports from various companies during the year, and from street lighting committees of different organizations, notably the Illuminating Engineering Society and the National Electric Light Association, there is an increased tendency toward ornamental lighting. In most cases single-lamp, or at the most double-lamp, posts are being adopted instead of clusters which were popular several years ago. The introduction of gas-filled lamps has in general resulted in increasing the candlepower used rather than in decreasing the wattage. Most of the gas-filled lamps have been of the series type, but multiple units are employed in central districts. Standard fixtures predominate, but a number of cities have adopted specially designed fixtures. San Francisco lighting, described on page 457 of this issue, is notable in this regard. Most changes now contemplated are to gas-filled lamps or improved arc lamps, with the former used exclusively in some places.

INSTALLATION AND MAINTENANCE COSTS FOR VARIOUS CITIES

AUBURN, N. Y.—When the Empire Gas & Electric Company revises its lighting contract this year, it is possible that the present system will be changed to 4-amp. magnetite lamps or to 400-cp. Mazda C lamps.—*Arthur D. Smith, Supt.*

CANTON, OHIO.—The city has recently entered into a contract for street lighting with Mazda C lamps. A complete survey of the city was made, taking into account the requirements of the individual locations. The spacing throughout averages about 285 ft., but will vary in a few cases from 180 to an extreme of 380 ft. On the main thoroughfares lamps of 400 cp. are to be used, and on the residence streets 250-cp. lamps. For the secondary business districts, which includes all of the downtown section except the two main streets on which a "white way" will be installed, an ornamental system of 250 and 400-cp. lamps, spaced about 150 ft. apart, has been adopted.

CHARLESTON, S. C.—By an agreement with this city, the Charleston Consolidated Lighting & Railway Company is to replace by Dec. 31, 1917, all old-type enclosed arc lamps with Mazda C Westinghouse lamps. The change is now under way, and 36 per cent of the substitutions have been made. The cost per lamp for the new installation is about $22 each.—*G. H. Waring, Vice-President and General Manager.*

CHICOPEE, MASS.—The municipal electric department is replacing 4-amp. metallic flame arc lamps with 1500 6.6 Mazda C lamps. Eventually, 3000 fixtures will be installed. On some streets the lamps, which are 100 cp. units are spaced 100 ft. apart, while on other streets, they are 200 ft. apart. A few higher rated units will also be used.—*R. P. Benedict, Manager.*

EVANSVILLE, IND.—The illumination with the new lamps installed in Evansville is far superior to that obtained with the old style lamps. The average cost of installing the new lamps is approximately $50 each. The maintenance cost per annum is as follows: 1000 cp. $37.65; 600 cp., $22.55; 250 cp., $13.50, and 100 cp., $6.27.—*Horace T. Sharp, Manager of New Business.*

FORT WAYNE, IND.—Compensator-type fixtures were employed with the nitrogen-filled lamps installed by the city of Ft. Wayne. The lamps and fixtures cost $18 compared with $30 for the old-style magnetite lamps. Pole-type voltage regulators are employed to maintain constant current in the gas-filled lamp circuits. Switches are installed in the primary line of the regulators so the street lamps can be controlled from the power house. "We think the Mazda C unit is the coming lamp for street illumination."—*F. J. Dix, Superintendent.*

HELENA, MONT.—By changing the series arc lamps to Mazda C lamps, the Helena Light & Railway Company estimates that it has effected a saving of 53,000 kw.-hr. per year. To utilize the old arc-lamp housing for the new type of lamp, the magnets and carbon tubes were removed and series sockets installed to hold the gas-filled lamps. The old arc-lamp shades were retained. Converting the fixtures cost about $1 apiece. The new lamps cost about $2.18 apiece, while the amount realized from selling the discarded material from the old arc lamp cases was about 55 cents per lamp. Thus, the total cost per lamp was about $1.62. By dispensing with the arc lamps, the services of lamp trimmers were eliminated, thus saving $117.50 per month. With the present arrangement, a meterman inspects the circuits once a week at a cost of $72 a year. Since the cost of mak-

Street Lighting Statistics for Cities Over 25,000 Population, Showing Types of Lamps and Rates for Service

Population	City and State	Company	Present Lamp Equipment: No.	Size and Type	Rate per Year	Annual Load	Date of Change
2,762,522	Boroughs of Bronx and Manhattan, New York	New York Edison Co.	9,020	400 and 600 cp. multiple Mazda C	Sliding scale for the number specified of $43 to $85 per lamp per year		1915 and 1916
			1,775	200, 300, 400, 500-watt series Mazda C			
2,331,542	Borough of Manhattan, New York	United Elec. Lt. & Pwr. Co.	535	200-400-watt lamps	$45.00-$77.00		
			24	100-watt Mazda	$24.60-$22.10	All night	
				60-watt Mazda	$20.00-$24.50		
2,185,283	Chicago, Ill.	Lincoln Park Commissioners	1,200	15-amp. 400-cp. series Mazda C	$30.00	1,152,000 kw.-hr.	
			5,681	Type B and incand.	$20.00		
		Municipal Street Ltg.	7,509	100-cp. incand.	Rents 12 magnetites at $62.50 and 60 inclosed multiple arcs and 1,264 West. flame arcs at $75; 1,275 25-watt lamps rented at $6	4,015 hours	
			12,061	20-amp. 600-cp. incand. *series G. E. flame arcs*			
			9,444				
			200	*10 amp. 465-watt West. stave flame arcs*			
			6,133	25-watt multiple tungsten			
		Commonwealth Edison Co.	1,000 (app.)	Mazda C mostly	$75.00	All night	
1,634,351	Borough of Brooklyn, N. Y.	Edison Elec. Ill. Co. of Brooklyn	7,500	100-cp. series and 100-watt Mazda C mult.	$25.00	7,500,000kw.-hr.	1914–1915
				200-watt mult. and 250-cp. Mazda C series	$48.00		
				300-watt mult. and 400-cp. Mazda C series	$75.00		
				400-500 and 750-watt Mazda C mult.	$85.00 $90.00 and $110.00 resp.		
687,029	St. Louis, Mo.	Union Elec. Lt. & Pr. Co.	2,000	6.8 Amp. G. E. Magnetite Arcs	$12.25 per 1000 arc lamp hrs.	4,440,799 kw.-hr.	
670,585	Boston, Mass.		4,923	*6.6-amp. 500-watt d.c. magnetite*	$87.52		
			26	*6.6-amp. 500-watt flame-arc*	$148.05		
			2,917	40-cp. 50-watt tungsten	$18.33		
			1,176	60-cp. 75-watt tungsten	$21.14	3,828 hours	
560,663	Cleveland, Ohio	Cleveland Elec. Ill. Co.	16	80-320-cp. 100-400-watt tungsten	$25.48-$84.08	All night	Remodeling at present time
			900	400-cp. series Mazda C	$49.80		1915–1916
560,663	Cleveland, Ohio	Municipal	638	1500-cp. multiple Mazda C	$75.00 all night	3,000 kw.-hr. per lamp per year	
				1,000-cp. multiple series Mazda C	$68.40 all night	2048 kw. hr. per lamp per year	
558,485	Baltimore, Md.	Cons. Gas Elec. Lt. & Pwr. Co.	3,405	*320 and 500-watt arcs*	$60.00 and $74.00	All night	
			2,686	40-watt tungsten	$20.00 and $36.00	and mid-night	
423,715	Buffalo, N. Y.	Buffalo Gen. Elec. Co.	3,000 (app.)	450-watt series inclosed	*$50 for overhead lines regardless of lamp size and $69 for underground circuits.	All night	
			700	*6.6-amp. 530-watt arc inverted magnetite*			
			1,400	*4-amp. 320-watt magnetite*			
381,617	Cincinnati, Ohio	Union Gas & Elec. Co.	6,500	*4-amp. magnetite*	$55.00	3,914 hours	
			625	75-watt tungsten	$13.00		
325,000	Seattle, Wash.	Municipal	1,250	400-cp. Packard Mazda C	4.5 cents per kw.-hr.	5,324,000kw.-hr. in 1915	1914–1915
			15,200	80-cp. Packard Mazda C		5,500,000kw.-hr. for 1917 probably	
331,069	Washington, D. C.	Potomac Elec. Pwr. Co.	1,086	*4.5-amp. 520-watt magnetite and 6.6-amp. 550-watt multiple arcs*	$59.50 to $97.50	All night	
			5,903	Series Mazda C	$15.00 to $36.50		
			517	Multiple Mazda C 50 to 187-watt			
301,408	Minneapolis, Minn.	Minneapolis Gen. Elec. Co.	3,000	*6.6-amp. magnetite series arcs*	$57.50	10,000,000 kw.-hr.	
			450	5-light standards	$45.00		
			650	1-light standards, using 60 to 100-watt incandescent lamps	$30.60		
284,041	Borough of Queens, New York City, N. Y.	New York & Queens Elec. Lt. & Pwr. Co.	14,135	100-cp. Mazda C	$21.75	4,000 hours	Summer and fall of 1915
			1,632	400-cp. Mazda C	$75.00	4,000 hours	
			153	600-cp. Mazda C	$90.00	4,000 hours	
237,752	Louisville, Ky.	Louisville Gas & Elec. Co.	3,112	*4-amp. magnetite*	$56.00 and $60.00	All night	
233,650	Indianapolis, Ind.	Merchants Ht. & Lt. Co.	2,777	*Westinghouse Type H inclosed flame series arcs*	$41.98		April 1, 1915
			390	150-cp. 10-amp. series Mazda C		6,397,168kw.-hr.	
			263	250-cp. Mazda C			
			380	150-cp. 123-volt multiple Mazda C	$27.71		

Population	City and State	Company	Present Lamp Equipment: Number	Size and Type	Rate per Year	Annual Load	Date of Change
67,452	Norfolk, Va.	Virginia Ry. & Pwr. Co.	668	6.6-amp. a.c. series arcs	$58.00	All night	
			1,825	75-watt Mazda	$22.00		
67,105	Wilkes-Barre, Pa.	Wilkes-Barre Co.	917	7.5-amp. *incl. series G. E. arc*	$54.00	All night	
			226	60-watt Mazda	$35.00		
65,064	Savannah, Ga.	Savannah Elec. Co.	788	4-amp. *G. E. series metallic flame arcs*	$60.00	1,126,110kw.-hr.	1909–1912
64,205	Oklahoma, Okla.	Oklahoma Gas & Elec. Co.	429	6.6 *amp. G. E. arcs*	$60.00	1,044,762kw.-hr.	
			392	100-watt incand	$15.00		
			293	150-watt incand.	$18.00		
63,933	Fort Wayne, Ind.	Municipal Elec. Lt. & Pwr. Co.	150	600-cp. series Mazda C	$53.00		1915
61,627	Little Rock, Ark.	Municipal Little Rock Ry. & Elec. Co.	784	*4-amp. 320-watt arcs*	$32.00	4,000 hours	
			31	*4-amp. G. E. arcs*	$65.00		
58,833	Charleston, S. C.	Charleston Consol. Ry. & Ltg. Co.	369	6.6-amp. 600 cp. West. Mazda C	$54.00	466,000 kw.-hr.	
58,571	Portland, Me.	Cumberland County Pwr. & Lt. Co.	111	*G. E. series and multiple arcs*	$60.00		Have been replacing arc lamps gradually for past few years
			3,691	50-watt series	$16.00		
				100-watt series and multiple	$30.00	662,825 kw.-hr.	
				250-watt series	$40.00		
				500-watt multiple	$60.00		
				4-light clusters	$60.00		
58,547	East St. Louis, Ill.	East St. Louis Lt. & Pwr. Co.	638	*6.6-amp. series magnetite arcs*	$65.00	All night 1,459,314 kw.-hr.	1911
			67	*6.6-amp. series magnetite arcs*	$45.00	Half night	
58,157	Terre Haute, Ind.	Terre Haute, Indianapolis & Eastern Trac. Co.	800	*4-amp. magnetite arcs*	$67.00	All night	Installed eight years ago
56,878	Brockton, Mass.	Edison Elec. Ill. Co. of Brockton	200	*6.6-amp. G. E. inclosed carbon arcs*	$85.00		
			1,500	6.6-amp. 60-cp. Mazda C			
51,913	Allentown, Pa.	Lehigh Valley Lt. & Pwr. Co.	120	600-cp. Buckeye multiple	$64.00	192,000-kw. hr.	Now being installed
51,521	Mobile, Ala.	Mobile Elec. Co.	555	*6.6-amp. a.c., incl. arcs*	$60.00	4,000 hours	
			97	80-watt series incand.	$20.00		
50,000	Topeka, Kan.	Municipal	48	44-amp. *272-watt Wes. flame arcs*	$38.20	Moonlight	
			200	80-cp. series incand.	$19.20		
			1,265	60-100 watt multiple			
46,921	Springfield, Ohio	Springfield Lt., Ht. & Pwr. Co.	700	250 and 600-cp. Mazda C series	$32.50 and $50.00	4,000 hours	Change being made
			315	3-light ornamental posts, each carry 300-cp. incand.	$35.00 per post	One light all night, two midnight	
45,941	Little Rock, Ark.	Municipal	834	4-*amp. series magnetite*	$32.00		Five years ago
45,401	Rockford, Ill.	Rockford Elec. Co.	703	*6.6-amp. G. E. series arcs*	$52.00		
45,166	Bay City, Mich.	Municipal	676	4-amp. *metallic flame*	$55.00	All night	
43,973	Lincoln, Neb.	Municipal Plant	300	600-cp. Type C A.B. fixtures and old lamps rebuilt			Last fall
			210 (app.)	*W. E. 7.5-amp. series arc lamps*			
43,916	New Britain, Conn.	United Elec. Lt. & Wtr. Co.	85	*5-amp. G. E. luminous arcs*	$75.00		Waiting for material to make change
43,697	Salem, Mass.	Salem Elec. Ltg. Co.	825	60-cp. incand.			
			204	250-cp. incand.	$38,000 total		
			104	400-cp. incand.		4,000 hours	
			50	*Magnetite arcs*			
43,684	Topeka, Kan.	Municipal	470	*275-watt metallic flame arcs*	$38.00	295 kw.	1909
			54	400-cp. incand.	$35.00		
			200	80-cp. incand.	$22.00		
			1,265	60-watt incand.	$36.00 per 5-light post		
			350	100-watt incand.			
43,028	Davenport, Iowa	Peoples Lt. Co.	794	*4-amp. G. E. & Wes. magnetite arcs*	$57.00	1,208,000kw.-hr.	

218,149	Rochester, N. Y.	Rochester Ry. & Lt. Co.	2,500	600-cp. series	$68.00 underground	5,050,000kw.-hr. (estimated)	
							Past eight months
41,040	Augusta, Ga.	Augusta-Aiken Ry. & Elec. Corp.	134	20-amp. 15-volt Mazda C	$60.00		
40,665	Macon, Ga.	Macon Ry. &	500	*4-amp. series magnetite*	$60.00		All night

218,149	Rochester, N. Y.	Rochester Ry. & Lt. Co.	2,500	600-cp. series	$68.00 underground	5,050,000kw.-hr. (estimated)		
				Mazda C	$57.95 overhead			
207,214	Portland, Ore.	Portland Ry., Lt. & Pwr. Co.	3,395	*4-amp. 320-watt magnetites*	$51.60	All night		
			157	*4-amp. 440-watt multiple magnetites*	$63.60			
200,000	Columbus, Ohio	Municipal	2,648	*6.6-amp. 400-watt inclosed arcs*	$44.52	All night		
			6,025	100-watt Mazda B	$7.26			
154,839	Atlanta, Ga.	Georgia Ry. & Pwr. Co.	1,571	*7.5-amp. 450-watt series G. E. inclosed arcs*	$50.00		One year ago	
			313	*7.5-amp. 420-watt series G. E. flame arcs*	$55.00	4,000 hours		
			1,126	75-cp. series incand.	$22.00			
			481	5-light posts with 100-watt units	$30.00 post	1,800 hours		
137,249	Syracuse, N. Y.	Syracuse Ltg. Co.	750	5-light standards (50-watt series) tungsten	$47.50 post	All night		
			2,000	4-amp. *magnetite arcs*	$68.00			
129,867	Scranton, Pa.	Scranton Elec. Co.	1,924	*6.6-amp. 480-watt G. E. series inclosed arcs*	$50.00			
			510	32-watt series incand.	$15.00			
125,000	Dayton, Ohio	Dayton Pwr. & Lt. Co.	900	462-watt d.c. *series arcs*	$66.00			
			100	75-watt series tungsten	$24.00	3,830 hours		
112,571	Grand Rapids, Mich.	Municipal Plant	1,234	*2,000 cp. arc*	$56.90	All night		
			1,880	25-100 watt carbon and Mazda	3 cents per kw.			
			320	5-light posts with 60-100-watt Mazda				
104,839	Cambridge, Mass.	Cambridge Elec. Lt. Co.	2,080	40-250-watt Mazda B and C		Midnight and all night		
			60	1000-cp. Mazda C ornamental standards			Two years ago	
			100	*6.6-amp. magnetite*	$98.00	All night		
104,402	Spokane, Wash.	Washington Water Pwr. Co.	1,410	*4-amp. G. E. magnetite arcs*	$72.50	midnight		
					$48.00			
102,054	Bridgeport, Conn.	United Ill. Co.	750	*1,200-cp. magnetite arcs*	$71.17	All night		
			400	60-cp. Mazda	$23.00			
100,000	Hartford, Conn.	Hartford Elec. Lt. Co.	571	700-cp. series Mazda	$50.00-$60.00			
			1,743	125-cp. series Mazda	$17.00 overhead—$22.00 underground			
			477	300-cp. series Mazda	$80.00 double, $55.00 single standards			
96,652	New Bedford, Mass.	New Bedford Gas & Edison Lt. Co.	454	375-cp. inclosed arcs	$80.00			
			48	450-cp. magnetite	$95.00	All night		
				100-cp. and 250-cp. Mazda C	$18.24 and $44.00			
86,368	Des Moines, Iowa	Des Moines Elec. Co.	354	*500-watt G. E. arcs*	$65.00			
			1,850	6.6-amp. 40-cp. series incand.	$17.04	All night		
89,336	Lynn, Mass.	Lynn Gas & Elec. Co.	327	*4-amp. 320-watt magnetite arcs*	$82.40	All night		
			34	*6.6-amp. 515-watt ornamental magnetite arcs*	$82.40	All night		
			119	*6.6-amp. 515-watt ornamental magnetite arcs*	$70.00	Midnight		
			1,504	5.5-amp. 60-cp. Mazda	$15.00			
83,743	Tacoma, Wash.	Municipal	1,076	100-cp. Mazda C series (bracket and standard)			1914–1915	
			1145	250-cp. Mazda C series (bracket and standard)				
			48	400-cp. Mazda C series (bracket and standard)				
			59	Carbon flame arcs (standards and suspended)				
			61	Inclosed arcs				
79,803	Yonkers, N. Y.	Yonkers Elec. Lt. & Pwr. Co.	317	*6.6-amp. G. E. series inclosed arcs*	$92.00	4,000 hours		
79,066	Youngstown, Ohio	Youngstown & Sharon St. Ry. Co.	3,970	100-cp. Mazda series C	$13.55	All night	1915	
			285	600-cp. Mazda C	$60.16	All night		
					$44.10	Midnight		
			260	1,000-cp. Mazda C	$66.33	All night		
					$47.36	Midnight		
78,466	Duluth, Minn.	Duluth Edison Elec. Co.	500	6.6-amp. 420-watt *G. E. series inclosed arcs*	$45.00	900,000-kw-hr.		
			750	40-watt series incand. and in outlying districts 50-watt multiple	$15.00	4,000 hours		
77,403	St. Joseph, Mo.	Municipal	726	*4-amp. 320-watt magnetite arcs*	$48.00	All night		
73,141	Waterbury, Conn.	United Elec. Lt. & Water Co.	1,008	15-amp. 400-cp. series Mazda C	$48.00	430 kw.	Autumn of 1915	
72,826	Schenectady, N. Y.	Schenectady Ill. Co.	922	*4-amp. 320-watt G. E. d.c. series magnetite arcs*	$60.00	3,936 hours	1912	
			69	*6.6-amp. 500-watt series magnetite arcs*	$92.00	3,936 hours	1913	
			107	80-watt series Mazda C	$28.00	3,936 hours		
70,000	Wichita, Kan.	Kansas Gas & Elec. Co.	319	*240-watt magnetite arcs*	$64.00	All night		
					$35.00	Midnight		
			1,016	100 and 400-cp. Mazda C	$16.00 and $50.00	All night		
69,647	Evansville, Ind.	Evansville Pub. Service Co.	1,600	1,000-cp. Mazda C	$55.00		1914	
				600-cp. Mazda C	$45.00	1,385,106kw.-hr.		
				250-cp. Mazda C	$27.00			
				100-cp. Mazda C	$18.00			
41,040	Augusta, Ga.	Augusta-Aiken Ry. & Elec. Corp.	134	20-amp. 15-volt Mazda C	$60.00			Past eight months
40,665	Macon, Ga.	Macon Ry. & Lt. Co.	500	*4.4-amp. series magnetite arcs*	$60.00	All night		
			500	4-amp. incand.	$24.00			
39,983	Charleston, Mass.	Charleston Gas & Elec. Co.	288	6.7 G. E. series *Magnetite arcs*	$87.52			
38,524	Tampa, Fla.	Tampa Elec. Co.	300	600-cp. 20-amp. series Westinghouse luxolite	$75.00			Aug. 1, 1916
			99	*4-amp. series luminous arcs*				
			26	250-cp. series incand.				
			251	100-cp. series incand.				
			44	60-cp. series incand.				
38,494	Dubuque, Iowa	Dubuque Elec. Co.	645	600-cp. series Mazda C	$67.50 for the first 425, $62.50 for all over 425	765,000 kw.-hr.		Fall of 1914
						200,000 kw.-hr. guaranteed		
37,000	St. Petersburg, Fla.	St. Petersburg Elec. Lt. & Pwr. Co.	16	60-cp. Mazda C	$18.00			
			465	100-cp. Mazda C	$24.00			
			116	250-cp. Mazda C	$48.00			
36,981	Galveston, Tex.	Municipal	15	600-cp. series Mazda C	Purchase energy at about 2 cents per kw.-hr.	1,500,000kw.-hr. including white way		
			40	5-lamp standards (four 160-watt and one 100-watt lamp each)				
			600	*4-amp. G. E. form 12 magnetite*				
36,587	Quincy, Ill.	Quincy Gas, Elec. & Htg. Co.	502	*7.5-amp. series inclosed arcs*	$52.50	Moonlight		
36,346	Knoxville, Tenn.	Knoxville Ry. & Lt. Co.	513	*6.6-amp. 500-watt series Adams Bagnall*	$72.50	All night		
			188	25-cp. incand.	$22.00			
35,279	Hamilton, Ohio	Hamilton Lt. plant	357	*7.5-amp. 500-watt G. E. series arcs*		All night 640,000 kw.-hr.		
			454	7.5-amp. 80-cp. series Mazda				
35,099	Lexington, Ky.	Lexington Util. Co.	567	*6.5-amp. 490-watt series-multiple Adams Bagnall (5 in series)*	$74.00	1,450,380kw.-hr.		
			45	100-watt Mazda	$27.50			
			180	25-watt Mazda	$4.20			
			45	40-watt Mazda	$6.55			
34,874	Roanoke, Va.	Roanoke Ry. & Elec. Co.	430	*7.5-amp. a.c. series arcs*	$49.78	All night		
			47	80-cp. series incand.	$15.00			
34,668	Auburn, N. Y.	Empire Gas & Elec. Co.	573	*6.6-amp. G.E. Form 10 series luminous arcs*	$72.00	All night 1,562,500 kw.-hr.		
			38	50-cp. series incand.				
34,259	Taunton, Mass.	Municipal Plant	1,750	60, 250, 600 and 1,000-cp. series Mazda C	$34.00	650,000 kw.-hr.		In 1915 and 1916 installed 1,450 of the 1,750 lamps
						4,000 hours		
33,062	Oshkosh, Wis.	Oshkosh Gas Lt. Co.	439	6.6-*amp. G.E. series inclosed arcs*	$60.00	Moonlight		
32,121	Pittsfield, Mass.	Pittsfield Elec. Co.	51	6.6-*amp. luminous series arcs*		800,000 kw.-hr.		October, 1: 15
			125	600-cp. Mazda C series	$65.00			
31,860	Williamsport, Pa.	Lycoming Edison Co.	268	4-amp. form 8 *series arcs*	$39.60	2654-amp. magnetite arcs		April, 1916
			72	40-watt series incand.				
31,297	Jamestown, N. Y.	Municipal Plant	300	400-cp. 6.6-amp. series Mazda C with Cutter fixtures	$48.00 charged until actual cost is determined			March, 1915
31,229	Lansing, Mich.	Board of Wtr. & Elec. Lt. Comm.	640	6.6-amp. 250-cp. series Mazda C	$36.00	360,000 kw.-hr.		1915
30,417	La Crosse, Wis.	Wisconsin-Minnesota Lt. & Pwr. Co.	274	*4-amp. magnetite arcs*	$55.00			
			305	40 and 60 watt Mazda	$36.00	All night		
30,291	Pasadena, Cal.	Municipal	1,774	80-cp. 6.6-amp. series overhead	$12.00			Past several years
			23	100-cp. ditto.	$15.00			
			20	200-cp. ditto.	$48.00			
			26	250-cp. ditto.	$48.00			
			1	350-cp. ditto.	$60.00			
			80	400-cp. ditto.	$48.00			
			145	600-cp. ditto.	$60.00			
			1	1,000-cp. ditto.	$60.00			
			1,627	Ornamental posts	3.5 and 3 cents per kw.-hr. for overhead & underground resp.			
30,000	Muskogee, Okla.	Muskogee Gas & Elec. Co.	423	45-*watt a.c. series arcs*	$55.00			
29,630	Orange, N. J.	Municipal	372	4-*amp. G. E. series luminous arcs*	$59.30			
29,494	Lynchburg, Va.	Lynchburg Tract. & Lt. Co.	415	7.5-*amp. a.c. inclosed arcs*	$49.27	All night		
			52	125-watt multiple gem	$15.30			
29,292	Council Bluff, Iowa	Citizens Gas & Elec. Co.	44	6.6-*amp. G. E. inclosed arcs*	$85.00			
			50	10-*amp. flame arcs* (underground)	$95.00	All night		
			32	10-*amp.* (overhead)	$90.00			
			752	60-cp. incand.	$21.25			

*Except for 6.6-amp. magnetites which bring $75. (Arc Lamps in Italic, Incandescent Lamps in Roman Type.)

Street Lighting Statistics for Cities Over 25,000 Population, Showing Types of Lamps and Rates for Service—Continued

Population	City and State	Company	Present Lamp Equipment				Date of Change	Population	City and State	Company	Present Lamp Equipment				Date of Change
			No.	Size and Type	Rate per Year	Annual Load					No.	Size and Type	Rate per Year	Annual Load	
28,026	Zanesville, Ohio	Ohio Elec. Ry Co..	204	100-cp. series a.c. Mazda C (34 miles overhead line)	$21.00	4,000 hours	Sept. 1	25,401	Chicopee, Mass.	Municipal	1,500	100-cp. Mazda C series (few larger)	$14.00 probably		1914
			280	250-cp. ditto (52 miles)	$35.00	4,000 hours		24,814	Everett, Wash.	Puget Sound Trac., Lt. & Pwr. Co.	569	100, 200 and 350-cp. series tungsten	$16.80, $33.60 and $54.00		
			14	250-cp. ditto (52 miles)	$25.00	2,000 hours									
			62	400-cp. ditto (10 miles)	$47.25	4,000 hours		24,000	Muskegon Mich.	Consumers Pwr. Co.	177	*4-amp. 380-watt series magnetite.* Some have been substituted by 400-cp. single-light posts with Mazda C lamps	$57.50 all night $52.50 until 1 p.m. $40.00 all night $32.00 until 11 p.m.		February, 1916
			3	600-cp. ditto (1 mile)	$52.00	4,000 hours									
			1	120-amp. 1,000-cp. ditto (0.25 mile)	$70.00	4,000 hours									
			3	250-cp. ditto (0.5-mile underground)	$40.00	4,000 hours									
			21	250-cp. ditto (0.5-mile)	$29.00	2,000 hours		23,975	Fort Smith, Ark.	Fort Smith Lt. & Trac. Co.	362	*6.6-amp. inclosed arcs*	$55.00		
			18	400-cp. ditto (0.5-mile)	$54.00	4,000 hours									
			118	400-cp. ditto (0.5-mile)	$69.00	2,000 hours									
			12	600-cp. ditto (0.5-mile)	$80.00	4,000 hours									
			22	20-amp. Mazda C	$39.00	2,000 hours		23,368	Oswego, N.Y.	Peoples Gas & Elec. Co.	500	250, 400 and 600-cp. series Mazda C	$48.00 and $60.00	500,000 kw.-hr.	100 lamps per year beginning 1915
29,875	Norristown, Pa.	Counties Gas & Elec. Co.	41	250-cp. Mazda C, G.E. series	$45.00	58,520 kw.-hr.	June, 1916								
			12	400-cp. ditto	$60.00			23,253	Stockton, Cal.	Western States Gas & Elec. Co.	640	600-cp. series Mazda C	$56.73	218 kw.	
			18	600-cp. ditto	$72.75										
27,149	Newport, R. I.	Bay State St. Ry. Co.	200	*4-amp. series luminous inclosed arcs*	$91.00 overhead $100.00 underground	345,726 kw.-hr. (actual)	January, 1916								
26,693	Waterloo, Iowa	Citizens Gas & Elec. Co.	14	20-amp. 300-watt Mazda C with G.E. Novalux fixtures and compensators	$63.00	164,335 kw.-hr. (estimated)		22,996	Charleston, W. Va.	West Virginia Water & Elec. Co.	55	*Ornamental 4-4-amp. 330-watt G.E. forms 10 and 17 series arcs*	$60.00 all night $44.50 midnight		January and April, 1915
											260	Residence lighting	$20.00		
26,425	Waco, Texas	Texas Pwr. & Lt. Co	465	*4-amp. series magnetite arcs*	$66.00	700,000 kw.-hr.	1911				95	80-cp.			
								22,982	Pensacola, Fla.	Pensacola Elec. Co.	90	6.6-amp. 250-cp. G.E. form 6 Novalux			April, 1916
26,398	Sheboygan, Wis.	Sheboygan Elec. Co.	258	20-amp. 600-cp. series	$68.00 all night	480,000 kw.-hr.	September, 1914				500	60-cp. incand.			
								22,760	Paducah, Ky.	Municipal	276	*4-amp. 360-cp. G.E. magnetite arcs*	$40.40 moonlight		
			112	15-amp. 400-cp.	$55.00 all night $37.50 midnight										
25,908	Kingston, N. Y.	Kingston Gas & Elec. Co.	460	*4-amp. G.E. series magnetite arcs*	$70.00	750,000 kw.-hr.	1913	21,262	Jackson, Miss.	Jackson Lt. & Trac. Co.	267	*4-amp. G.E. luminous arcs*	$90.00		May, 1914
			600	32-cp. incand.	$16.00	All night		20,814	Vicksburg, Miss.	Vicksburg Lt. & Trac. Co.	150	80-cp. series incand.	$25.00		
											150	6.6-amp. *G.E. series inclosed arcs*	$32.50 all night		1915
25,745	Wilmington, N. C.	Tide Water Pwr. Co.	96	1,000-cp. Mazda C series (white way)				19,989	Sandusky, Ohio	Sandusky Gas & Elec. Co.	1,350	250-cp. series Mazda C	$21.00 half night $27.00 on brackets		
			65	400-cp. " " " (business section)								100-cp. " " "	$16.00		
			300	60-cp. " " " (residence district)								60 -cp. " " "	$13.00		
25,577	Clinton, Va.	Clinton Gas & Elec. Co.	90	400-cp. Mazda C with holophane reflectors	$48.00	All dark nights	1915								

ing lamp renewals is estimated to be about $85 per year the total yearly cost for the incandescent lamp circuits is $157. In 1915 the cost for arc lamp repairs and trimming was $588, which shows a saving of $431 for the new system. The number of outages has been reduced with the change, the incandescent lamps having shown an average life of 3000 hr.—*C. A. Bernier, Superintendent of Electrical Department.*

JAMESTOWN, N. Y.—About 225 enclosed arcs have been replaced by 300 Cutter incandescent suspension fixtures with Holophane refractors. The fixtures with lamps cost about $2,700. An additional $1,300 was spent in rearranging and adding to the old circuits. By these changes, provision was made for the additional lamps required at the time and seventy-five to eighty others which might be needed in the future. A new seventy-five-light circuit would have cost between $4,000 and $5,000 in addition to the lamps and station apparatus. The change proved very satisfactory, and the lighting is superior to the old system. The saving in operating and maintenance expenses is between 10 and 15 per cent.—*C. O. Johnson, Assistant Superintendent.*

LYNCHBURG, VA.—We have just entered into a new contract with the city to replace 7.5-amp series enclosed arcs and will install the equipment which calls for about 700, 100 to 600-cp. Mazda C units, within six months.—*L. G. Gresham, Superintendent.*

NEWARK, OHIO—The cost of installing the new lamps is about $5.18 per lamp. New station equipment for operating the revised street lighting system is just being received for installation. It cost $30,000. The nitrogen-filled lamps which are being substituted for the enclosed arc lamps are being installed gradually while the old plant is still in operation. The new generating equipment is being installed for greater economy.—*W. C. Christian, Director of Public Service.*

PENSACOLA, FLA.—No change in the circuits or wiring was involved in changing to the new type of street lighting used in Pensacola. The cost of installation including the lamps was about $20 per lamp. Since the services of lamp trimmers have been dispensed with the maintenance cost is much less than with old arc lamps. The Mazda C lamps and the 500 60-cp. incandescent lamps which have been in service for some time are connected to the same tub transformers and have operated very satisfactorily.—*J. G. Holtzclaw, Gen'l Supt.*

PITTSFIELD, MASS..—Company installed lamps and city pays for operation and maintenance. Fifty-nine ornamental standards containing luminous arcs are employed which cost $175 a post to install and are requiring $1,101 per year for operation and maintenance.

PORTLAND, ME.—Ornamental street lighting in Portland, Me., consists of four lamp posts carrying 100-watt lamps grouped so each may be automatically turned off and on from switches in the series circuits. The cost of installing these poles with the lamps was approximately $90 apiece. In making the changes, three 250-watt incandescent lamps have been substituted for two arc lamps, the rates for the two propositions being the same.—*W. C. Billings, Superintendent of Power and Lighting Department.*

SEATTLE, WASH.—The rate of 4½ cents per kw.-hr. which the municipal lighting department of Seattle, Wash., has been charging for street lighting is said to include operating and maintenance expense as well as the fixed charges on the street lighting system. The rate for 1917 has been reduced to 4 cents, however. Despite this change, it is claimed by the lighting department that there is still a good profit. The change to Mazda C lamps which has been conducted on a large scale in Seattle was made gradually with practically no added expense over regular operation except for the cost of the lamps installed. Maintenance of the new type of lamps, it is declared, is much less than on the arc lamps.

SPRINGFIELD, OHIO.—The new street lighting contract which the Springfield Light, Heat & Power Company recently closed not only includes the installation of 250-cp. and 600-cp. Mazda C lamps, but also 315 ornamental post lamps, each bearing three 100-cp. incandescent lamps, two of which burn until midnight and one all night. Compensation for these lamps will be on a basis of $35 per post per year, the contract specifying that the company shall furnish the conduits only and deliver secondary service at street intersections.—*W. Parsons, Treasurer and Manager.*

SUFFOLK, VA.—Maintenance of old system was very high for past few years owing to age of equipment. Many outages were experienced for which company was penalized. Average life of lamps about 1200 to 1700 hr. Illumination considered increased 100 per cent. Average cost of lamps installed including poles, wires and fixtures $25.—*R. J. Brinkley, Division Superintendent.*

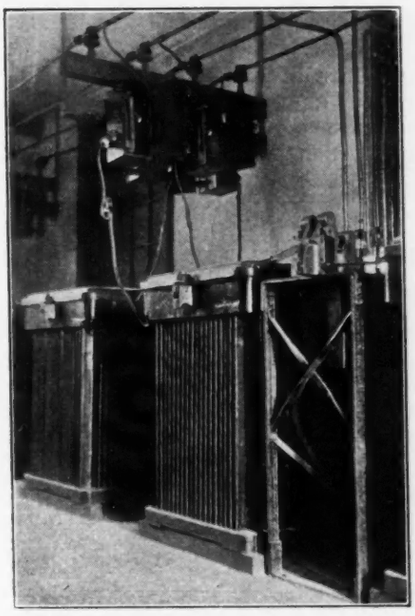
STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

PRIMARY SWITCHES REDUCE TRANSFORMER CORE LOSSES

Indiana Company Estimates an Annual Saving of $39 in Core Losses for 400 Kw. Industrial Installation Which Justifies Primary Switches

The Indiana Railways & Light Company of Kokomo, Ind., has installed two Westinghouse type D oil switches in the primary circuits of two of its power customers' transformer installations, and has made arrangements with these customers whereby the switches will be tripped to prevent transformer core losses at night and on Sundays. The switches installed on the customers' premises were spare units that had been taken from the powerhouse switchboard to make way for units of greater rating. That the practice pays and would pay, even if the switches had to be purchased new for the service, is shown by the following data on an installation at the factory of the Globe Stove & Range Company.



INDUSTRIAL PLANT OIL SWITCH OPENED EVENINGS TO AVOID CORE LOSSES IN TRANSFORMERS

The installation consists of four 100-kw. Westinghouse single-phase power transformers connected to a two-phase, four-wire, 2300-volt primary line, and a 50-kw., 2300-volt lighting transformer. The primary leads to the four power transformers are run through Matthews fuse switches and through the type D oil switch. The fuse switches had been installed before the oil switch was added to the installation, and were left in the circuit for overload and short-circuit protection. No attempt is made to interrupt the core loss on the lighting transformer, but the oil switch on the power circuit is always opened when the stove works is not operating.

The guaranteed core loss on each of the 100-kw. units is 518 watts. During the six working days of the week the four units are out of service fourteen hours a day, and on Sundays the circuit is open for twenty-four hours continuously. The saving, therefore, amounts to 518 watts $\times$ 4 units = 2072 watts $\times$ 14 hr. per day = 29,008 kw.-hr. per working day. Multiplying this figure by six working days a week and adding the twenty-four-hour core loss for a single Sunday gives 223.7 kw.-hr. core loss per week, or 11,632 kw.-hr. year that would be wasted if units remained in the circuit at all times.

The coal cost alone at the Kokomo plant will average about 1/3 cent per kilowatt-hour, so that a conservative estimate of the actual saving amounts to $1/3 \times 11{,}632 \div 100 = \$38.77$ per year. The list price of the type D switch, according to a recent quotation, was $41, which is probably much more than the Kokomo company paid for the units several years ago when they were originally installed in the powerhouse.

P. H. Palmer, assistant manager and assistant treasurer of the Kokomo company, in commenting on the installation said that there had been no difficulty in getting the industrial plant customers to open and close the switches. When the installation was made it was pointed out to the executives of the plant that opening the switches would protect the transformers from lightning at night and thus afford better service, and at the same time reduce fire hazard in the plant as well as save core loss for the central station company. In view of these facts the industrial plant executives detail a man to operate the switch mornings and evenings.

An Aid in Installing Heavy Lighting Fixtures on Trolley Poles

While erecting street-lighting fixtures at Peru, Ind., the installation crew found two scaffolds of the type shown in the accompanying illustrations very useful. The brackets which were being attached to tubular trolley poles for supporting 6.6-amp. series incandescent lamps, weighed 295 lb. each. With these scaffolds a crew of five men were able to erect fifteen of these brackets in a day, including the time for drilling four 5/8-in. holes in the pole for circuit outlets, and for moving the scaffolds. A second trip over the entire instal-

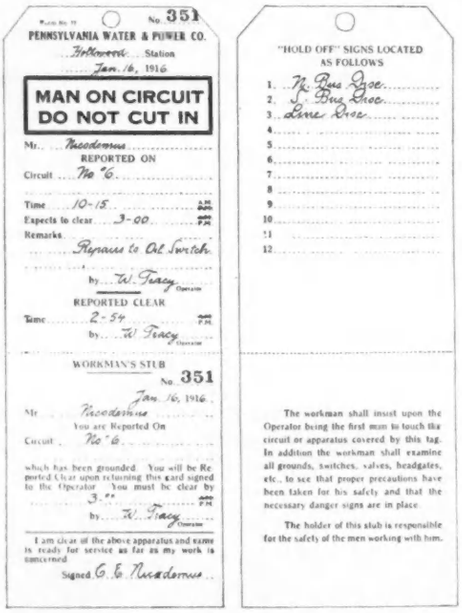
PORTABLE SCAFFOLD USED TO INSTALL LIGHTING FIXTURES ON TROLLEY POLES

lation of fifty-three units was made to mount the lamps.

Each scaffold was made in two parts and arranged so that it could be taken apart by removing three bolts. Two men generally worked at changing the scaffold positions while the remaining three men used the electric drill and hoisted and mounted the brackets. A. C. Herren, manager of the Peru Municipal Electric Light & Water Plant, under whose direction the work was done, placed the cost of the scaffolds at about $2.50 each; however, since in the end the bolts and lumber of which they were made will go back into stock, the actual cost is mainly in the labor of making them.

Hold-Off System for Protecting Station and Line Men

Before any employee of the Pennsylvania Water & Power Company is allowed to repair any apparatus he is required to inform the station operator which piece it is and about how long he will be engaged. If the operator decides that conditions permit cutting the apparatus out of service for the period specified, he proceeds to isolate the equipment from the rest of the



PENNSYLVANIA WATER & POWER CO.

No. 351

Hollwood Station

Jan. 16, 1916

MAN ON CIRCUIT
DO NOT CUT IN

Mr. Macadorms

REPORTED ON

Circuit No 6

Time 10-15 AM

Expects to clear 3-00 PM

Remarks Repairs to Oil Switch

by W. Tracy Operator

REPORTED CLEAR

Time 2-54 PM

by W. Tracy Operator

WORKMAN'S STUB

No. 351

Jan. 16, 1916

Mr. Macadorms

You are Reported On

Circuit No 6

which has been grounded. You will be Reported Clear upon returning this card signed to the Operator. You must be clear by 3-00 PM

by W. Tracy Operator

I am clear of the above apparatus and same is ready for service as far as my work is concerned

Signed G. G. Macadorms

"HOLD OFF" SIGNS LOCATED AS FOLLOWS

1. No Bus Oper
2. S. Bus Disc
3. Line Disc
4.
5.
6.
7.
8.
9.
10.
11.
12.

The workman shall insist upon the Operator being the first man to touch the circuit or apparatus covered by this tag. In addition the workman shall examine all grounds, switches, valves, headgates, etc., to see that proper precautions have been taken for his safety and that the necessary danger signs are in place.

The holder of this stub is responsible for the safety of the men working with him.

FORM OF HOLD-OFF CARD USED BY PENNSYLVANIA WATER & POWER COMPANY

system, grounding it if necessary, and then fills in a card like that shown above and indicates also in a log book the time that he did so. Meanwhile, all disconnecting switches, circuit-breakers, etc., the closing of which might endanger the repairman are blocked and tagged with standard hold-off cards, note being made of the location of hold-off tags on the back of the card. When this has been done, the lower part of the card filled in by the operator is detached and given to the repairman to indicate that he has received permission to carry on his work. The upper portion of the card is retained by the operator and placed on the switch or mechanism that controls the particular piece of apparatus to be worked on. When the job has been completed, the workman signs the stub he previously received and, after indicating the time thereon, returns it to the operator, who then restores conditions to normal. The time at which this is done is entered on the log sheet so that comparisons may be made when desired with the time signed by the workman.

If several men not reporting to the same foreman request permission to work on the same circuit or piece of apparatus, each one is provided with a card of permission and the upper halves are attached to the control switch. The remainder of the procedure is exactly the same as with one man working, except that apparatus cannot be cleared until all permission cards have been signed and turned in by the workmen. Corresponding halves of cards are then fastened together and filed with the daily reports.

It may be pointed out that additional precautions are taken to prevent accidents. For instance, if a man is working in the wheel pit of a turbine a sign indicating the fact is hung on the head-gate control. A lock and chain is also attached to the governor and hand-control valves. If lightning arresters are being worked on, ground jumpers are attached to the choke coil of the circuit. The clamps on the conductor grounding devices are held closed by springs. Hooks and eyes are provided on the clamps to permit handling with a switch hook. When apparatus is taken out of service a sign to that effect is attached to it in a conspicuous position. The signs on some apparatus, like transformers, are made reversible, so that one side reads, "Danger—keep off," and the other side, "Out of service." Each sign is supported on a turning post so that the desired side can be turned to view and locked there. Pilot lamps are placed near the transformers to indicate whether the high-tension and low-tension oil switches are open or closed.

How an Indiana Company Saves Secondary Circuit Copper by Use of Overhead Ground Wire

On a 5-mile, 2300-volt, delta-connected, three-phase line operated between Marion and Sweatzer by the Marion (Ind.) Light & Heating Company, the overhead ground wire has been utilized as the return circuit for secondary lines serving farm customers. With the connections shown in the accompanying diagram two farm customers may be served by a single transformer placed equidistant between their houses, the

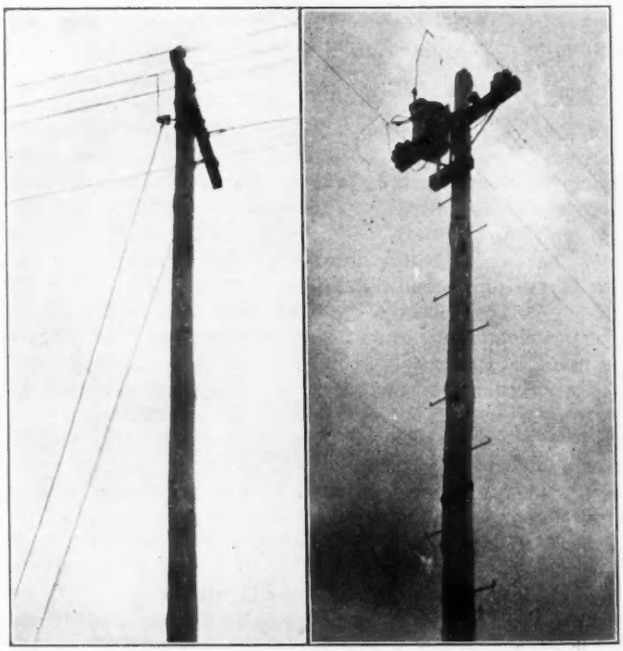


FIG. 1—CIRCUIT ARRANGEMENTS WHEN USING GROUND WIRE FOR SINGLE-PHASE SERVICE

only addition to the existing pole line being a single secondary wire, the service leads and insulators. As will be noted from the sketch, one side of the transformer secondary is connected to the ground wire, which is grounded at every other pole. The other side of the transformer secondary is connected to a fourth No. 6 copper wire which is strung between the two farm

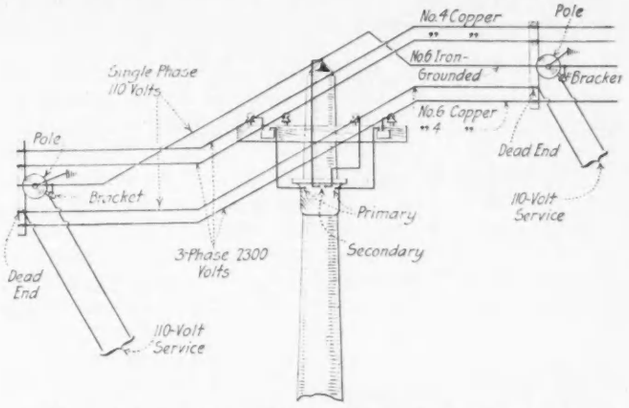
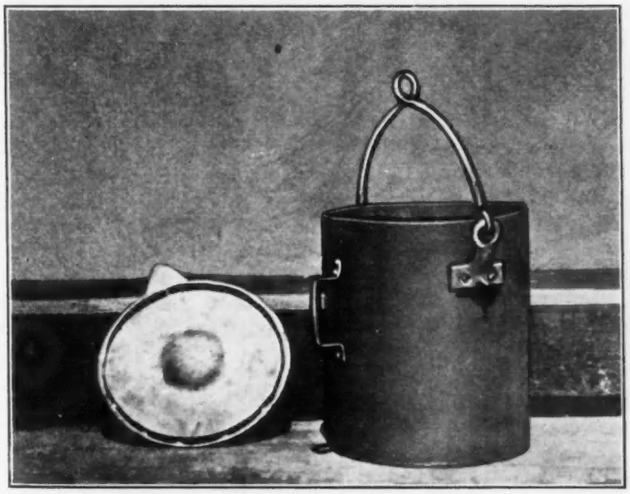


FIG. 2—SERVICE WIRES TO FARMER'S HOUSE AND CONNECTIONS AT TRANSFORMER POLE

houses. Without sectionalizing the overhead ground wire the services are taken off as indicated. The longest run of secondary line on which this practice has been tried is 0.25 mile. Experience to date indicates that in addition to saving cross-arm space, transformers and copper wire, this scheme gives less trouble with lightning since there are fewer transformers to be damaged.

Special Receptacle for Hot Cable Compound

The accompanying illustration shows a special container employed by the Commonwealth Edison Company of Chicago for handling the better grades of hot compound used in high-tension cable work. It is made of $\frac{1}{8}$-in. iron plate, with bottom, handle, bail loops and spout all welded in place, and hence no degree of heat will affect their permanence. It is 8 in. in diameter and $9\frac{3}{8}$ in. high, and will hold sufficient compound to

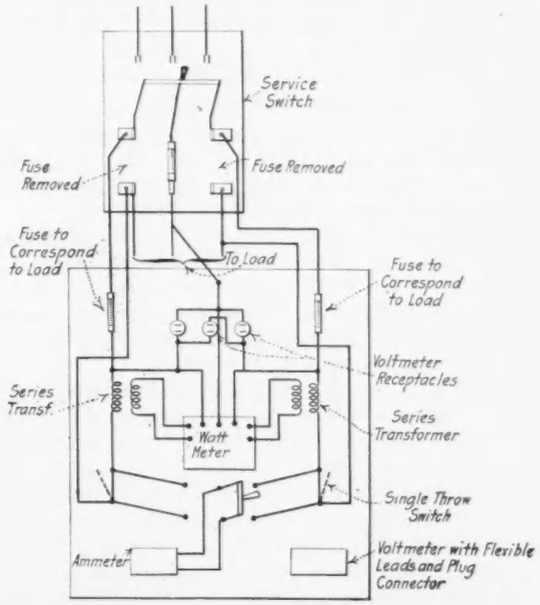


WELDED COMPOUND POT FOR HIGH TENSION CABLE WORK

fill a thin conductor joint. The loop in the middle of the bail serves an important function, since it prevents the hook from sliding over to the side and spilling hot compound when lowering the pot into a manhole with a rope. The bail loops are so placed as not to project above the top rim of the pot to facilitate stacking one on top of another. The cover was also designed with this feature in mind, being perfectly flat on top with a depression in the center and a bar welded across this depression to serve as a handle for removing the lid. A rim welded to the under side of the cover fits inside the pot and keeps the cover in place.

Portable Equipment for Testing Industrial Plant Motors

Extensive investigations have been and are still being made by a large manufacturing company in Bridgeport, Conn., to determine the most economical grouping of machines for motor drives, the proper settings for relays, the most deirable sizes of motors for different services, the acceleration of motors, and the like. To facilitate these analyses a portable test set is employed which can be connected in any main or branch feeder without interrupting service. The connections of equipment employed in the test set are indicated herewith. As shown, five leads have to be connected between the test set and the circuit switch. Screw terminals are provided on the lugs to which each fuse clip is attached so that the test set leads may be connected therewith be-



CONNECTIONS FOR PORTABLE MOTOR LOAD TEST SET

fore the fuses are removed. In order that the protection of fuses will not be eliminated, however, auxiliary fuse clips are provided in the corresponding circuits on the test set into which fuses of the proper rating can be inserted. Test-set terminals between which there is a large difference of potential are widely separated to minimize the possibility of accidental short-circuits during connection of apparatus.

It may be pointed out that the test equipment includes an ammeter, a voltmeter and a graphic wattmeter. The current coils of the wattmeter are energized by series transformers, the ratios of which may be easily changed to suit conditions. In series with the primaries of each of these transformers is a single-pole switch. The terminals of these switches are also connected with opposite ends of a double-blade, double-throw switch, the hinges of which are connected with the ammeter. To determine the current in either circuit the double-throw switch is thrown into the position connected with the particular circuit and the single-blade switch opened.

COMMERCIAL AND BUSINESS POLICY

A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service

THE "COOK-BY-WIRE STORE" AT PORTLAND, ORE.

A Shop Which Sells Electric Ranges Exclusively—How Every Electrical Man Can Promote Electric Cooking

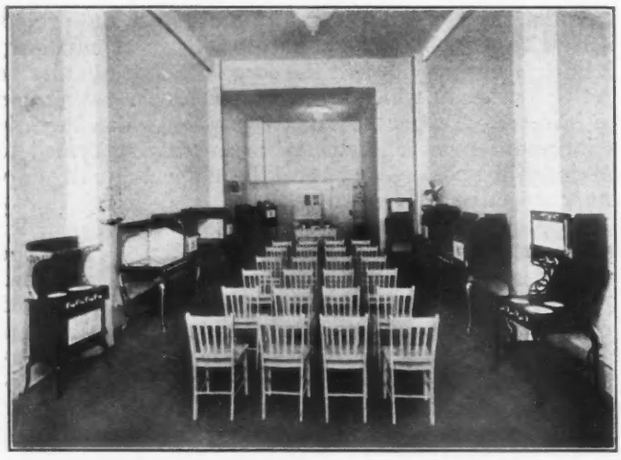
When the Northwestern Electric Company, which supplies electric service in Portland, Ore., first opened up its campaign on electric cooking, several ranges were installed in the company's general office for demonstrating "cooking by wire" to customers.

Finding that this did not prove satisfactory from a sales standpoint, and that it did not add to the general appearance of the office, the commercial department decided to open up a store for the sale of electric ranges exclusively. This store is 150 ft. from Washington Street, the principal thoroughfare of the city, measures 21 ft. by 60 ft., and is finished in white enamel throughout.

Arrangement of the Store

The rear of the store is made to represent a modern kitchen, with inlaid linoleum on the floor, imitation tile on the three walls, kitchen cabinet, ice box, electric water heater and tank and kitchen table, all white enameled. A meter is installed on the electric range used by the demonstrator and reads in watt-hours. A number of comfortable white enameled chairs, an electric fan, and indirect lighting fixtures are also provided. Flush receptacles are installed just above the baseboards so that all ranges on display in the store can be connected.

This showroom was named the "cook-by-wire" store, as this was found to be the best name from a psychological standpoint. The total cost of equipping the "cook-by-wire" store, excluding the ranges, was approximately $500. In it will be held monthly campaigns with free domestic science lectures by an experienced demonstrator. Luncheons are served to the various women's clubs of the city, accompanied by short talks on the advantages of cooking by wire. During the first month one range manufacturer furnished a "home economist" lecturer, and invitations were sent to consumers to attend these lectures on home economics, which were given each afternoon. The result of this first month's campaign was to sell sixty-four of this manufacturer's electric ranges. Since then a number of other electric ranges have been sold.



THE EXCLUSIVE ELECTRIC-RANGE STORE OF THE NORTHWESTERN ELECTRIC COMPANY, PORTLAND, ORE.

During another month ranges were sold at cost, dividing the payments over a period not exceeding twenty-four months and making no payment less than $3.

This "cook-by-wire" store is for the sale of electric ranges exclusively, and handles no other electric appliance of any kind. A central station opening up a store of this kind certainly proves to the public and the manufacturers that it believes in the electric range, points out one of the officials of the Northwestern Company.

Creating the Demand

"We realize that we could sell a great many more ranges if we could do considerably more advertising," he continues, "but the cost of the range is so high that if we added on even a small per cent of the cost of advertising we find that it brings the cost up so that we could not sell them on any kind of terms. We are losing money on every range sold in order to get the range introduced. If the manufacturers would co-operate and do some national advertising it would help us out tremendously. I believe in the manufacturers creating a demand. We are here to stand back of the ranges and close the sale, but interest must be aroused before we can start our sale, and the most effective way of getting interest aroused is by advertising.

"We find a very hearty co-operation among the local jobbers; most of them spend all their profits made on ranges in helping on various means of advertising and demonstrating. One of the local jobbers paid one-half of the expense of erecting a large steel sign 7 ft. by 17 ft. at a local apartment house where we are installing electric ranges.

"Electrical contractors and dealers in any city can be a great help in the electric range business. A number of our prospects who had already decided to install an electric range said at the last minute they had concluded they would not purchase a range now, as the electrical contractor who wired their house said that the electric range cost too much to operate and advised them not to purchase now. Others were told that to cook with electricity cost a great deal more than by other means of cooking. I find that this is the sentiment of many electrical men, and this, I believe, is a matter of ignorance on their part. I have one in my home, and it costs me some months 25 cents or 50 cents more than my gas cost, but its advantages are so much greater that I do not even consider that it cost me in the end a cent more than even gas at $1 per 1000. I cook for six in my family and my bill averages $3.50.

"When a man starts to buy an electric range or an appliance, he generally asks a friend, who is an electrical man (who may be a contractor, dealer, jobber, manufacturer, meter reader, repair man, wire-fusser, or an employee of any branch of the electric business), whether this electric appliance he expects to buy is a practical thing for him to have. If this friend knocks it, he will not make the purchase, and all effort on the

part of the salesman is lost in a second when some other electric man knocks the electric appliance.

A CREED FOR EVERY ELECTRICAL MAN

"I believe in the electric range with my whole heart and soul. I believe it is practical, and I believe we will all be cooking by wire before long and paying 3 cents per kilowatt-hour, too. When we first started in the electric range business we made a special canvass of electrical men and architects in the city in order to get them to cook by wire, so they could recommend the electric range to their friends. I offered all kinds of inducements, giving them the ranges at cost, we paying for the installation and letting them pay for the ranges on their own terms at $2 or $3 per month if they so desired. We sold half a dozen or more, and these people are good boosters for the electric range to-day.

"If all electrical men or even 10 per cent of the electrical men of the country would cook by wire in their own homes, it wouldn't be long until the other 90 per cent would also be cooking by wire.

"The electric range business holds a tremendous future for the central station, manufacturer, jobber, dealer and contractor. Let's all get together and boost with all our hearts. Buy a range for your own home, give it a trial, and you will see that we can boost the electric range game so that every central station, all contractors and dealers can sell the electric range, like the gas companies, furniture stores, hardware stores, department stores are selling gas, oil, wood and coal ranges to-day."

An Advance Campaign for Steam-Heating Business at Kokomo, Ind.

The president of the Indiana Railways & Light Company of Kokomo, Ind., has issued instructions to the company's new-business department, of which O. M. Booker is head, to devote a major portion of its time during the late summer months to securing heating business. The plan as mapped out at the beginning of the campaign was as follows:

About $100 is to be spent in newspaper advertising, followed by circular letters sent to a picked list of prospective customers whose places of business or residence are on the company's existing mains. Then each of these prospective steam users is to be visited personally several times during the month.

The company is protected against the demands of the isolated prospective customer not near existing mains by its franchise, which does not require it to extend its system unless a certain number of feet of radiating surface can be secured per block of extension. To combat the arguments of the man who says "It will cost too much," a book has been prepared showing the actual amounts of the bills for each of the company's customers for each month last season. It is the common thing for a prospective customer to declare that "Jones told him steam heat cost a certain large amount for just one month last winter." But a look at all of Jones' bills for the winter will disclose that he mentioned only the January bill, but forgot about the very low charges in the fall and spring months.

The steam heating system at Kokomo is now four years old, and is serving 104 customers with 140,000 sq. ft. of radiating surface. Everyone uses metered service. It is expected that this campaign will add twenty-five new patrons with a total of 20,000 sq. ft. radiation. Should the necessity for it arise, the company contemplates financing prospective customers' steam heating installations on a three-years-to-pay plan.

Following are ten arguments reproduced from the Kokomo company's advertisement in the local papers:

1—Central-station steam is convenient.
2—Central-station steam practically eliminates fire hazards.
3—Central-station steam is automatically controlled, and furnishes even temperatures 24 hr. per day, thus eliminating the annoyance of negligent janitors.
4—Operating costs as compared to other methods are very satisfactory—your coal bill, janitor hire, hauling of ashes, furnace repairs and loss of temper are all bunched in one item.
5—Central-station heating equipment does not depreciate as other systems do; no heating plant involved.
6—Central-station steam is clean, no coal, dust or ashes to contend with; it saves your decorations.
7—Kokomo's system is a tried system; you get the heat. Over 100 present satisfied customers will vouch for it.
8—Central-station service enhances real-estate values; it causes your rooms to become more attractive to tenants.
9—You can use your furnace room and basement for other purposes; it will be clean and safe from fire.
10—An efficient central-heating station is essential to a growing, progressive city such as ours, and if the system is right it deserves your patronage.

"White-Way" Lighting as a Factor in Friendly Relations with the Public

The new "White Way" of Oklahoma City, Okla., is the climax of a series of civic improvements in which the management of the Oklahoma Gas & Electric Company has been a leading factor.

The policy adopted by the management to encourage the feeling that the utility corporation is made up of citizens who are "intensely human," and to throw personality into every move that tends to make a contact with the public, received its heartiest indorsement on the evening when the governor of the state, the mayor and commissioners, and more than 300 city employees and 150 vehicles, led by the entire city fire department, participated in a municipal parade through the business section. Officials from near-by towns attended the big celebration. Enthusiastic speeches were made, the entire city turned out for a night of carnival, and, following the parade, a big street dance was held along the White Way, the proceeds going to the milk and ice fund for the poor.

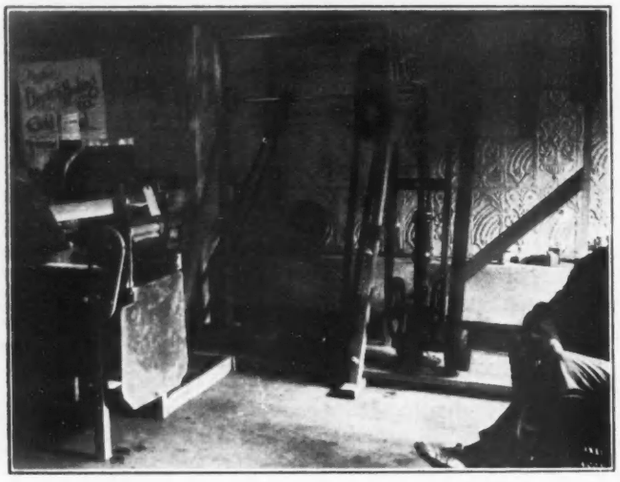
The cost of the White Way was $5,000, which was subscribed by business men. The lighting is to be maintained by the city at an approximate cost of $1,000

THE NEW MAGNETITE-ARC "WHITE WAY" INSTALLATION AT OKLAHOMA CITY, OKLA.

per annum. Eighty-four standards are surmounted by 1600-cp. luminous-arc lamps fed through an underground cable. The installation was done by a crew of thirty men from the Oklahoma Gas & Electric Company under the supervision of the manager, W. R. Molinard, assisted by W. P. Jones, contract agent of the company.

Pump Jacks Help Boost Suburban Business

It is the experience of the Benton Harbor-St. Joseph (Mich.) Railway & Light Company that a few pump jacks kept in stock help to increase the company's water-pumping business. The jacks used are of the double-



SEVERAL PUMP JACKS ARE ALWAYS KEPT IN STOCK IN THE BENTON HARBOR CENTRAL-STATION OFFICE

reduction type and can be attached to windmill pumps, or in fact to almost any kind of farm pumps. The jacks alone are sold for $15 each, or with a 0.5-hp. motor are priced at $75, which includes the cost of installation. The Benton Harbor company has about 100 of these motor-driven pumps ranging from 0.5 hp. to 5 hp. on its suburban and rural circuits, and by keeping some of the jacks in stock, it is always ready to provide quick pumping service to more prospective customers. The installation pictured herewith shows a farm-power installation, including one of the pump jacks which formed a part of the company's exhibit at an electrical show in the city.

Reducing to a Scientific Basis the Promise of Service Connections

The Commonwealth Edison Company of Chicago has adopted a new plan for handling the matter of promises of service connections which has eliminated 90 per cent of the complaints from this source. The plan resulted from an analysis of the time requirements of connecting services and the reduction of these to a formula by the use of which the number of days required between the time of signing the contract and of service installation can be accurately estimated. This data is then supplied to the contract department for the information of the customer. The contract department is thus enabled to make a promise which the company can live up to, and also to make special arrangements at the very beginning of relations to accelerate the order if the usual routine will not be satisfactory.

The plan began with the street department, which furnished a formula to the engineering department from which the latter could compute the time required by the former to install service. This formula is that the time required by the street department from its receipt of the order to put in a drop or extension is equal to twice the time required to do the work with one gang of men, plus two days. When a customer orders service the engineering department proceeds to make an estimate of the cost of material and labor to furnish this service. The labor cost is then divided by the value of one gang for one day, which gives the number of days or time to substitute in the above formula.

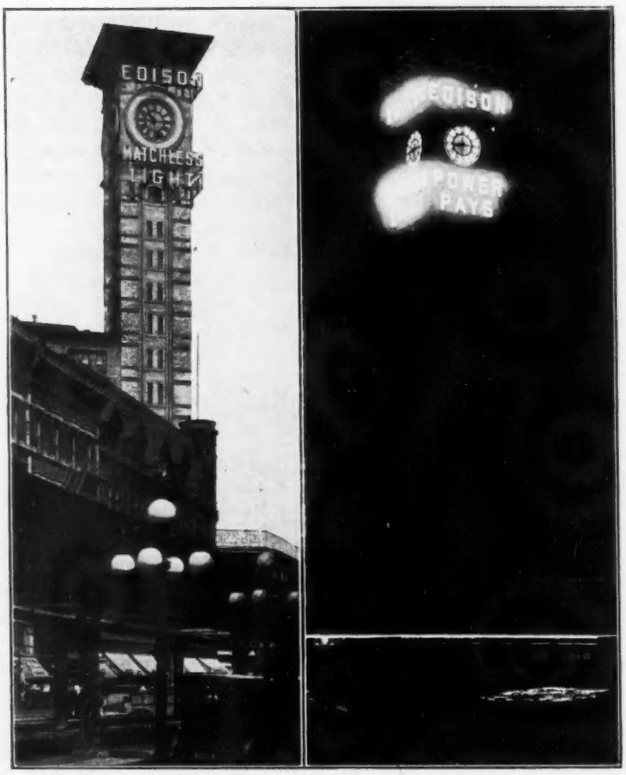
Using the formula, then, gives the time required by the street department, and to this is added the time required by the engineering department to prepare plans and the total time is recorded on the estimate sheet. Then, when the customer comes in to sign the contract the contract department has the data on hand from which it can tell him just when he can expect service.

New Central-Station Office Contains Special Showroom for Architects and Contractors

A feature of the new Pueblo (Col.) office building of the Arkansas Valley Railway, Light & Power Company is a special display room that has been fitted up in the basement containing equipment of special interest to architects and contractors.

The quarters open to the general public include a comfortable rotunda, equipped with seats for patrons, writing desks, electric fans, etc. Glass-inclosed electric meters explain the mechanism of these measuring devices for the benefit of customers, and a lamp board indicates the relative consumption of different sizes and types of lamps.

Brooklyn Landmark Now Bears Sign for "Edison Service"



The Brooklyn Edison Company has just leased the 168-ft. Smith-Gray tower, a Brooklyn landmark visible from all parts of the city, for its electric signs advertising central station service. The letters of the legend contain 987 10-watt and 15-watt lamps, which remain lighted from dusk to dawn. The clock is lighted by twenty-four 100-watt lamps.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

ELECTROLYTIC COPPER REFINING

An Elaborate Analysis of Metal Losses in a Copper Refinery

ELECTROLYTIC copper refining is of special interest for two reasons: First, it yields the high-purity copper for conductors; second, it was the first large electrochemical industry. The process of electrolytic refining as described in text-books is simplicity itself. How complicated it is in practice, however, and how constant vigilance is required to run a refinery economically, is evident from the very interesting analysis of the sources of metal losses in a copper refinery given by Lawrence Addicks in *Metallurgical and Chemical Engineering* of July 1, 1916. A flowsheet of the process under consideration is given in Fig. 1. There are seven principal sources of loss, outlined under the headings, *A, B, C, D, E, F, G.*

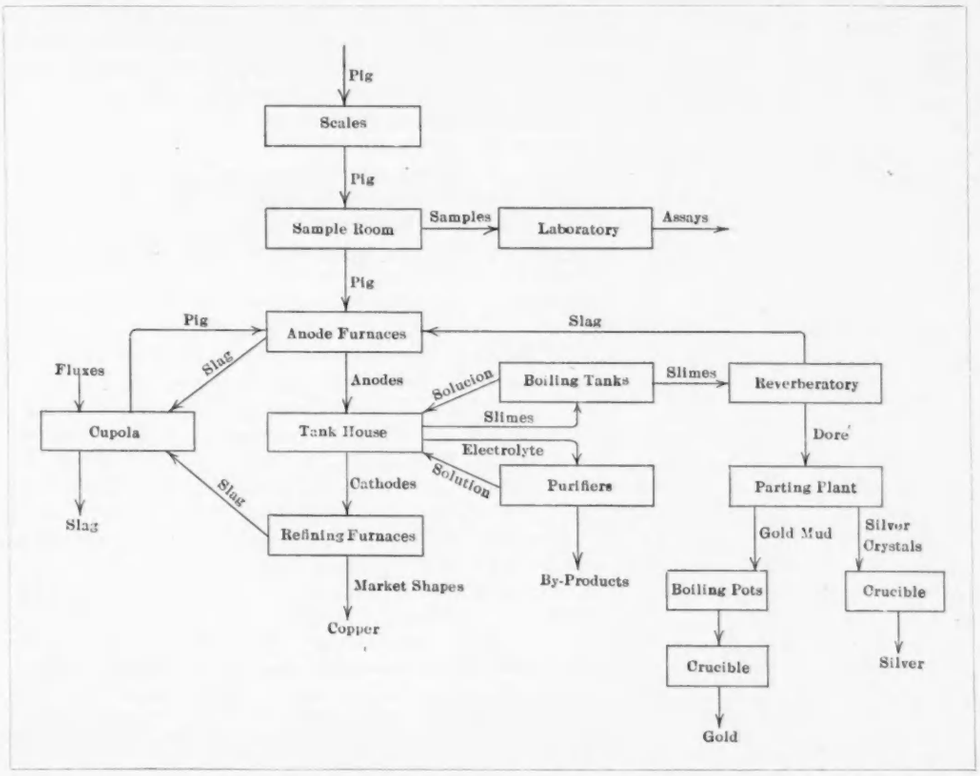


FIG. 1—STEPS IN THE ELECTROLYTIC REFINING OF COPPER

A. Weighing Losses.—It is customary to weigh outgoing copper in 5-ton drafts under such conditions that the refineries have been able to stand upon their weights as final, provided the consignee agrees with the count of pieces. In order to accomplish this two platform scales are placed in tandem, separate weighers taking readings and comparing figures before passing a lot.

The standard of weight is furnished by the certification of the United States Bureau of Standards of a 50-lb. brass weight as a "Class R or Working Standard." Against this are checked a sufficient number of 50-lb. cast-iron weights, adjustable by lead shot, to make up a full-scale load.

These weights are not suitable for every-day use, as they afford a great surface for the condensation of moisture, collection of dirt, etc., so a test car loaded with very heavy cast-iron weights is checked against them every two or three weeks, and this test car is used for daily checks on the merchant scales. In this way it is quite practicable to maintain the desired precision of 1 lb. in 10,000. As identical methods are used for weighing incoming blister and outgoing wire bars, there is at the present time but small chance of tracing any copper losses to scales in a modern plant.

In weighing the silver and gold the situation is somewhat different. The incoming silver and gold are weighed as blister copper, as outlined above, while the outgoing shipments are weighed as bullion. As the gold is always shipped to a United States assay office whose weights are final, we again come to government standards and have automatically a weekly check against the refinery bullion balance. In one of the large refineries a year's returns showed a difference of but 0.0015 per cent.

B. Sampling Losses. There are three sources of losses, due to moisture, to errors in sampling methods, and salting.

C. Assaying. This is subject to three sources of losses, due to assay methods, splitting limits, and assay errors.

D. Slag Losses. These, as explained by the author in detail, deserve the very careful study of the metallurgist.

E. Stack Losses. There are four such losses: losses from anode furnace stacks, refining furnace stacks, silver refining stacks, and cupola stacks. Perhaps the most interesting are the silver refining stack losses. The anode slimes consist of the insoluble impurities contained in the anode and run 30 per cent to 40 per cent in silver. The copper is mostly leached out as sulphate and the slimes are then melted and subjected to a series of oxidizing operations until a high-grade doré is obtained.

In general about 1 per cent of the silver treated and about 0.1 per cent of the gold is recovered by various means in the flue system, and great progress has been made in the last ten years in this practice. Until the

Cottrell system of electrostatic precipitation was successfully applied to treating these gases the opportunities for serious undetected losses were very great, and even now there is no point in a metal loss investigation which needs more careful watching.

The great difficulty is that the actual losses made are clearly discernible only after several years, as the results from single yearly inventories are always more or less clouded by anode furnace bottom absorptions which vary from year to year, and the punishment comes so long after the crime that it is very easy to be lax to the immediate benefit of apparent operating costs. Molten silver should be handled like a volatile liquid.

F. Process Losses. These may be classed as silver and gold in outgoing copper, silver in outgoing gold, gold in outgoing silver, minor losses, and process margin.

G. Handling Losses. These are classed as wind losses, theft, solution losses, soil losses and slimes losses.

While for the detailed discussion of the losses the reader must be referred to the original article, enough has been said to appreciate that constant thoughtful attention in a great many directions is necessary to make a minimum metal loss. As the precautions all cost money it raised the question whether the additional saving due to them pays. The answer to this is that it is only by constant schooling in all these precautionary measures that men can be trained to be really careful when they are on their own responsibility and not under observation. For this reason the liberal use of white paint and many other seeming extravagances are justified. The same rigid care and supervision in the weighing, sampling and assaying is required as in the control of slag, and cathode losses, and careful attention must be given on general principles to all the apparently insignificant sources of indefinite loss.

Wires, Wiring and Conduits

High-Tension Cable Joints.—C. Beaver.—The author gives an account of recent British practice in the manufacture, laying and jointing of 33,000-volt three-phase paper-insulated underground cables. The author first points out the advantages of drying and impregnating the paper before its application to the conductors, in order to insure uniform impregnation throughout every part of the cable dielectric, not only in a radial sense but also throughout its length. The design of the straight through joints used by the author on these cables is described in some detail, the chief feature being, firstly, substantial conductor joining ferrules turned with curved surfaces and ends designed to avoid concentration of stress which might arise either from an edge effect on the ferrule itself, or from a point effect due to the exudation of solder globules at the ends of the ferrule; secondly, the use of specially designed thor-

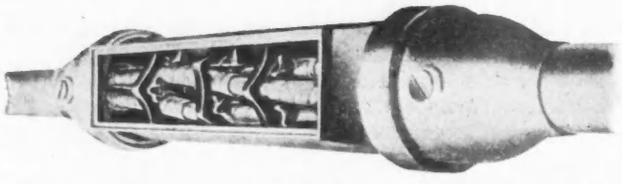


FIG. 2—CABLE JOINT IN ITS CAST LEAD SLEEVE READY FOR FILLING OPERATION

oughly vitrified unglazed porcelain spacers, which permit the elimination of wrappings of tape or paper, and reduce the dependence on jointer's workmanship to a minimum; and, thirdly, a special design of cast lead sleeve made in three parts, constructed to permit of efficient filling under ordinary atmospheric pressure conditions. Fig. 3 shows the cast lead sleeve with lid removed. The end portions of the sleeve fitted with vent plugs are cylindrical, and screw on to the central portion which is flask-shaped in section. The rectangular opening provided for compound filling by a simple pouring operation is closed after the sleeve is filled by a lid which is soldered all round its edges. The seating provided for the lid is such that no solder globules can penetrate to the

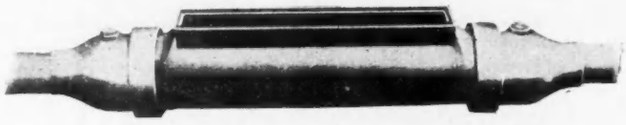


FIG. 3—CAST LEAD SLEEVE WITH LID REMOVED

interior of the sleeve. The general design insures that nothing but smooth surfaces of bold curvature exist in the vicinity of the conductor joints, anything in the nature of projections or edges being as far removed as possible therefrom. Fig. 4 shows the joint with porcelain spacers in position prior to the assembly of the three parts of the lead sleeve over it, these, as well as the hexagonal outer collars of the procelain spacers, being threaded over the cable before the conductor joints are made. The web portions of the spacers are slipped between the cores at equal distances from the staggered conductor joints, and given a right-angle turn to get them into a vertical plane, and the outer porcelain collars are passed on to their respective web pieces and turned through an angle of about 90 deg. to lock the two

FIG. 4—CABLE JOINTS WITH PORCELAIN SPACERS IN POSITION

parts together. Fig. 2 shows the joint in its cast lead sleeve, assembled ready for the plumbing and compound filling operations. Fig. 5 shows the joint as laid, complete with armor bond and inclosed in a cast-iron box for mechanical protection. In the same issue the article by P. Torchio, describing the methods of the New York Edison Co., is reprinted from Electrical World, April 15, 1916, page 877. In an editorial note the following comparison is made between American and British practice. "One of the fundamental differences in the two methods of jointing is the filling of the box and the compound used. Mr. Beaver recommends a solid compound and a simple pouring process for filling the box. Mr. Torchio, on the other hand, uses a liquid filler and

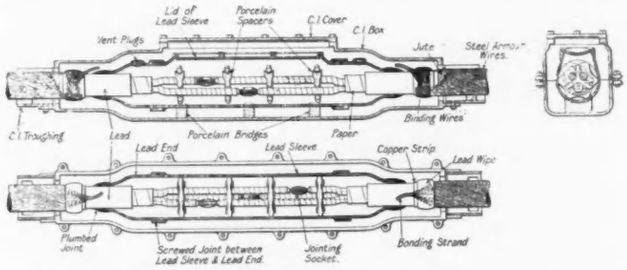


FIG. 5—SECTION OF COMPLETED JOINT IN ITS CAST-IRON BOX

subjects the joints to a 14-lb. vacuum before filling. The method of protecting the solid insulation against electrostatic charges by means of a metal gauze is ingenious, as also is the application of heavy lamp wick round the gauze to retain, by surface tension, the insulating oil in the splice. It is claimed that the joint described eliminates the trouble that has been experienced, in some

cases, of the liquid filler running into the cable and leaving voids in the joint. From the two articles it would appear that the solid-filled joint is the simpler, although we have no doubt that experienced jointers quickly become familiar with both methods of jointing, and the fact that fundamentally different methods are being used for practically identical services should furnish information of considerable value to makers and users of extra high pressure cables."—London *Electrician*, June 23, 1916.

Control Gear.—E. F. BUTLER.—An illustrated article giving many practical hints on details of construction of direct-current motor starters and control gears in general.—London *Elec. Review*, June 23 and 30, 1916.

Units, Measurements and Instruments

Correction for Thermo-electric Current to be Applied to the Throw of the Ballistic Moving-Coil Galvanometer.—PAUL E. KLOPSTEG.—A brief mathematical paper. From a consideration of the equations of periodic motion of a galvanometer coil under the conditions, first, that a steady electromotive force exists in the circuit and second, that the electromotive force is zero, two expressions are deduced. Each expression gives the correction for thermo-electric current to be applied to the ballistic throw on closed circuit, the discharge having taken place on open circuit. The equations involve simply the determination of the ratio of one amplitude of the coil to the one next following, together with factors which are obtainable from existing tables. The calculated and observed corrections are found to be in good agreement.—*Phys. Rev.*, June, 1916.

Roentgen-Ray Tube.—At a recent meeting of the Dresden Electrotechnical Association, Prof. F. J. Koch discussed the latest developments in X-ray equipment, and described a new tube construction due to Lilienfield. The nature of the discharge is independent of degree of vacuum, up to a certain point, if an incandescent cathode be employed in the vacuum tube. This principle is applied in the Coolidge tube by using a glowing tungsten spiral as cathode; diffuse cathode rays are sent off in all directions, and generate Roentgen rays where they impinge. The efficiency of the tube decreases rapidly with load, so that control of effect is not easy. With a view to overcoming this difficulty, Lilienfeld adds to the ordinary Roentgen ray tube a special ignition tube containing an incandescent cathode in the shape of an ordinary metal lamp filament. The main and ignition tubes may be excited by two transformers working in phase, or a single transformer (*T* in Fig. 6), may be used for both purposes. In Fig. 6, *G* represents the incandescent cathode, *K* the main cathode, and *A* the anticathode. A variable high resistance *R* is shunted between *K* and *A*, and adds considerably to the homogeneity of the rays.

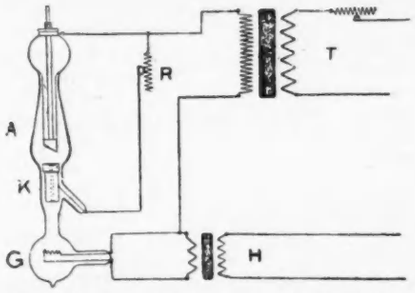


FIG. 6—CONSTRUCTION OF NEW RÖNTGEN RAY TUBE

The cathode *G* is made incandescent by an auxiliary transformer *H*, and when *T* develops the breakdown pressure, ignition current flows between *G* and *K*. The latter being tubular, cathode rays pass into the Roentgen tube itself, break down its high cathode resistance, and establish discharge between *K* and *A*. As compared with *R*, the internal resistance of the tube is so small that most of the current passes through it, and only a small part through the high-pressure resistance. As regards general construction, the anticathode is water-cooled, and since the glass shows no fluorescence (electrons being produced artificially), a fluorescent screen is mounted inside the tube to indicate its working.

It is claimed that this tube gives constant radiation at all loads, that the hardness or penetrating power of the rays can be varied easily and accurately either by altering the ignition current or by varying the setting of *R*, and the hardest or softest rays can be obtained at a moment's notice (irrespective of previous conditions) and maintained indefinitely in greater intensity than is possible with other tubes. The quantity of rays varies directly with the current strength, and the radiation is relatively homogeneous. Since no reflected cathode rays fall on the glass, the latter does not become hot in working; also no guard screen is necessary on account of Roentgen rays from the glass. Sharp negatives are obtained; and the life of the tube is practically equal to that of an ordinary glow lamp (so long as the anticathode is not prematurely damaged by overload), *i.e.*, the life is determined by the incandescent cathode instead of by consumption of residual gas by the cathode rays. The new tube is made with as high a vacuum as possible. A valve-tube with incandescent cathode is claimed to give excellent results, and to render unnecessary rectification of the high pressure transformer current. In order to keep the field stress in the spark transformer approximately symmetrical, Koch places a "directional resistance" (porcelain-sheathed aluminum rod in electrolyte contained by an iron vessel) in parallel with the transformer primary.—London *Elec. Rev.*, June 30, 1916.

Recording X-Ray Spectrometer.—ARTHUR H. COMPTON.—A paper in which a recording X-ray spectrometer is described by means of which a continuous record can be obtained of the ionization produced by a beam of X-rays reflected from a crystal as the angle of the crystal is varied. A spurious and irregular current in the ionization chamber was investigated and found to be due to a slight radioactivity within the ionization chamber. Methods are described whereby the effect of this radioactivity may be considerably reduced. The X-ray spectrum of tungsten was examined in some detail.

In addition to the seven lines already known, an indication was found of six others, two of which are, however, somewhat uncertain. The wave-lengths of the different lines were carefully determined. The relative intensities of the different order reflections of the same line are proportional to the areas under the humps produced in the record by the spectrum line; and the relative intensities of the first three orders in the spectrum from rock-salt were determined by measuring these areas. The observed intensities of the different orders indicate that polarization occurs when a beam of X-rays has been reflected by a crystal.—*Phys. Rev.*, June, 1916.

Electrophysics and Magnetism

Electrical Capacity of Gold-Leaf Electroscopes.—T. BARRAT.—An abstract of a London Physical Society paper. The method of sharing charges is used to find the capacity of electroscopes, the deflection of the instrument itself being used to determine the volt drop. The capacity was found to be under all conditions independent of the deflection.—London *Electrician*, June 23, 1916.

S. FRED SMITH

Men of the Industry

Changes in Personnel and Position— Biographical Notes

S. Fred Smith, who has just rounded out a quarter-century as general manager of the Salem (Mass.) Electric Lighting Company, has seen the company's equipment expand from an 800-hp. plant in 1891, to the present elaborate and modern system on which $1,000,000 has been expended in improvements alone since Salem's great fire two years ago. Mr. Smith is a native of Salem, and began his public utility work as an employee and later as manager of the local telephone company. Meanwhile he became a director of the young electric lighting company, and in 1891 succeeded A. S. Temple as its manager, which position he has held continuously to date.

Fred S. Troop, contract manager of the United Electric Light & Water Company, New Britain, Conn., has tendered his resignation to take effect Sept. 1.

Steven E. Gamble, who resigned as manager for the Great Western Power Company at Petaluma, Cal., has been appointed manager of the Electrical Appliance Company, San Francisco.

E. T. Foote, formerly of the New York office of the Cutler-Hammer Manufacturing Company, is now in charge of the company's Boston office, located in the Columbian Life Building, Boston.

E. D. Metcalf has been appointed superintendent of construction and assistant to the manager of the Union Light & Power Company, Franklin, Mass., and Mr. N. B. Stearns has been appointed power engineer of the company.

George P. Flading, for the last nine years a salesman in the eastern territory for the Trumbull Electric Manufacturing Company of Plainville, Conn., has been appointed manager of the Trumbull company's New York office at 114 Liberty Street, New York City.

Arthur H. Halloran, managing editor of the *Journal of Electricity, Power and Gas*, San Francisco Cal., has been appointed Pacific Coast representative of the Society for Electrical Development, Inc. Mr. Halloran's headquarters will be in the Crossley Building, San Francisco, Cal.

J. B. Long of the illuminating-engineering department of the Commonwealth Edison Company, Chicago, Ill., has been appointed contract agent for the Central Power Company at Grand Island, Neb.

H. W. Schmidlapp, local manager of the Montana Power Company at Livingston, Mont., has been transferred to Lewistown, Mont., to take charge of the Montana company's interests there, succeeding C. C. Simondson, who has been transferred to the Billings office.

J. L. White has been appointed manager of the Willamette Valley division of the Oregon Power Company, with headquarters at Springfield, Ore., succeeding A. Norman, who has resigned. Mr. White was formerly manager of the Albany division of the Oregon Power Company.

Arthur J. Sweet, formerly of the firm of Vaughn, Meyer & Sweet, consulting engineers, Milwaukee, Wis., has withdrawn from the partnership to open an independent office in Milwaukee for consulting practice in steam, electrical and illuminating engineering, with the engineering of street lighting installations as a specialty.

E. S. Hamblen has been appointed manager of the Union Light & Power Company, Franklin, Mass., succeeding the late P. Henry Clark. Mr. Hamblen has been engaged in utility work for the past thirteen years and until his new appointment was manager of the Randolph & Holbrook Electric Light Company of Randolph, Mass.

A. Jackson Marshall, for the past three years secretary of the Electric Vehicle Association of America, which organization was merged last March with the National Electric Light Association as its Electric Vehicle Section, was recently appointed executive representative of the commercial section, and will be in charge of the various activities of that section at the New York headquarters. The growing importance of central-station commercial development, and the widening scope of commercial activities, necessitated the appointment of a competent man of experience to support committee work, create suitable general information and data files, take care of details incident to publications, and in many other ways assist the section. Mr. Marshall continues as secretary of the Electric Vehicle Section.

Dr. William McClellan, consulting engineer of New York City and former chief engineer for the New York Public Service Commission for the Second District, has been appointed dean of the Wharton School of Finance and Commerce of the University of Pennsylvania, Philadelphia, one of the principal undergraduate departments, with more than 2000 students. Dr. McClellan was graduated from the arts department of Pennsylvania University in 1900. During his college course he received the Quaternions Prize, was elected a member of both Phi Beta Kappa and Sigma Xi, honorary fraternities, and received special honors in mathematics. In 1903 he obtained the degree of doctor of philosophy in physics, mathematics and philosophy. For a time Dr. McClellan was engineer in charge of construction for the Philadelphia Rapid Transit Company. In 1905 he became supervising engineer for Westinghouse, Church Kerr & Company, and in 1907 his present association with H. T. Campion of Philadelphia in the engineering business commenced. In 1911 he was appointed electrical engineer and chief of the division of light, heat and power of the Public Service Commission of the Second District of New York State. Dr. McClellan is a fellow and vice-president of the American Institute of Electrical Engineers, a member of its executive committee and vice-chairman of its public-policy committee. He is one of the two representatives of the institute on the joint conference committee of engineering societies. He is also president of the joint Pan-American engineering committee. He has long been interested in steam railroad electrification and was for a number of years chairman of the electrification committee of the New York Railroad Club. He has also been greatly interested in workmen's compensation and is a director in the Utilities Mutual Insurance Company. Dr. McClellan is also a member of the American Society of Mechanical Engineers, of the American Society of International Law, of the American Economic Association, the Academy of Political Science in the City of New York, the American Political Science Association, of the Merchants' Association of New York, and of the American Gas Institute. He is also actively engaged in the work of national preparedness as a member of the New York board of directors of the Naval Consulting Board.

DR. WILLIAM McCLELLAN

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Thermally Controlled Domestic Hot Water System

The Electric Sales Service Company, of San Francisco, Cal., has developed a thermally controlled water-heater which is designed for use in standard 30-gal. and 60-gal. kitchen boilers without necessitating any alteration or additional plumbing for its installation. In Fig. 1 is shown a 30-gal. kitchen boiler which has been converted to an automatic electric water-heating apparatus for continuous operation by merely removing the side and bottom water-back connections and respectively inserting the thermostat and 250-1500-watt annular ring heater. The conversion is completed on reconnecting the drain pipe to the outlet of the terminal box and inclosing the boiler and piping in a suitable boiler cover. With adequate heat insulation, under test a 30-gal. boiler charged to 160 deg. Fahr. showed a radiation loss between 40 and 50 watts, depending on the surrounding air temperature. This indicates that the monthly radiation loss should not exceed 30 to 35 kw.-hr.

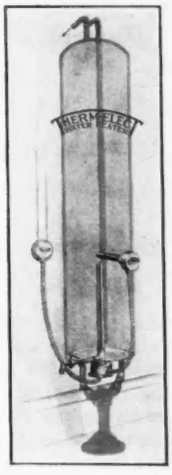


FIG. 1—PHANTOM VIEW OF TANK WITH HEATER INSTALLED

The heating element is just short enough so that it may be easily inserted or removed from the bottom tap without the need of lifting the boiler from its stand. Due to the intermittent operation effected by the thermal control, there is continually a slight opening and closing of the annular ring, being caused by the difference in amount of metal on the inside and outside surface of the heating tube. This action is amplified by expansive copper sheathing and makes the heater self-cleaning, all scale and precipitate being cracked off and accumulated at the bottom, where it may be flushed out. It is an established fact, it is asserted, that the precipitation of scale is largely overcome by eliminating high working temperatures, and to this end the heater has been provided with from three to seven times as much radiation surface per watt rating as has been the general practice in water-heater design. This large radiation surface is said to accomplish four results: (1) Keeps the working point of the resistance material at the most conservative temperature of 450 deg. Fahr. and thereby assures long life of the heating element; (2) reduces the temperature of contact surface between shell and water to a point at which the minimum precipitation of deposit is produced; (3) increases the speed of the heater, reduces the flushing of cold and hot water, and thereby increases the temperature regulation at the top of the tank; (4) assures absolute continuity of service in case the water-heater is subjected to operation as an air heater by a failure in the watermain pressure draining the tank, the thermal control being just as effective operating in air as in water.

Where excessive amounts of clay and mud are encountered, the cold-water inlet is teed into the drain and a check or globe valve is inserted in the line to still retain the drain at the bottom of the tank. This arrangement passes the silt on through the service pipes and slightly reduces the temperature regulation, but automatically keeps the tank cleaned of organic, bacterial silt and maintains the heater at the highest possible thermal efficiency. The single heating tube contains six or more individual and independently operated heating units of 250 watts each. Each section is independently controlled by the thermostat, and the regulation is such that the individual units are consecutively cut on and off the service line, one at a time, at intervals of not less than one minute, depending upon the rapidity with which hot water is drawn.

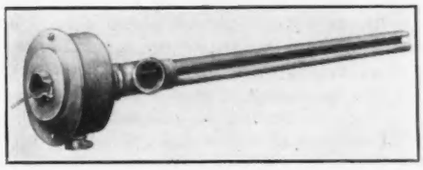


FIG. 2—HEATING ELEMENT

Electrical connection between the heater terminal box and the thermostat is effected by a flexible armored cable containing one lead for each heater unit. The cable is permanently fixed to the thermostat cap. The leads from the thermostat may be connected in any order whatsoever to the several binding posts in the heater terminal box, which arrangement makes it impossible to make a mistake in installing the equipment.

The thermostat is so designed that arcing and burning of the contacts are avoided and all mechanical stresses and strains which, by producing fatigue of the metal, would result in loss of adjustment, are eliminated. A vertical travel of 0.75 in. is obtained for a 10-deg. change in temperature of the water surrounding the thermostat. This movement is produced by pure linear expansion which occurs in the "Therm-Elect" alloy used in the barrel of the thermostat. The motion is then transmitted to the contacts by a mechanism which is entirely free from any stresses or strains and contains no riveted straps, couples or other expansive devices which would cramp or break down the adjustment when continuously exposed to a temperature range of 100 deg. or more. Temperature regulation as close as 1/16 deg. Fahr. is obtained. The contact points are 0.1 in. in diameter, and are designed to carry a load of 250 watts.

Contact is made by gravity action and is constant at all times, never being in excess of the weight of the drop-heads. This feature in that the contraction of the thermostat below the 150-deg. or 160-deg. working range will not cramp or deform the contacts or contact platform by imposing upon them all of the force of contraction. Adjustment of the thermostat for any working temperature between 60 deg. and 260 deg. Fahr. is readily accomplished by turning in or out the adjustment screw, the head of which is just behind the column supporting the horseshoe to which the pig-tails are attached. For permanence of adjustment a lock-screw is provided, which is reached from a well in the thermostat tongue; 160 deg. Fahr, has been determined as that point at which the best temperature regulation for the greatest economy is to be obtained, and hence all thermostats are set at 160 deg. Fahr. The thermostat cap is then

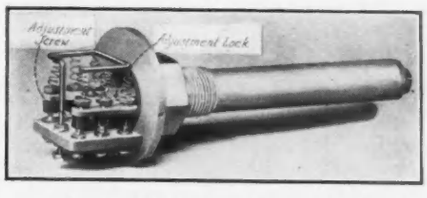


FIG. 3—THERMOSTAT, SHOWING ADJUSTMENT MECHANISM

locked on by a meter seal which makes the device fool-proof, relieves the housewife of all responsibility and assures her of a continuous and automatic supply of water at 160 deg. Fahr, until such time as she may call the service

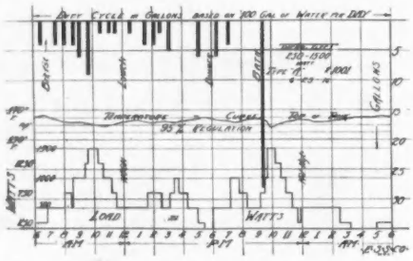


FIG. 4—PERFORMANCE WIRES

man to readjust the thermostat to such new higher or lower temperature as she may think better adapted to her particular needs.

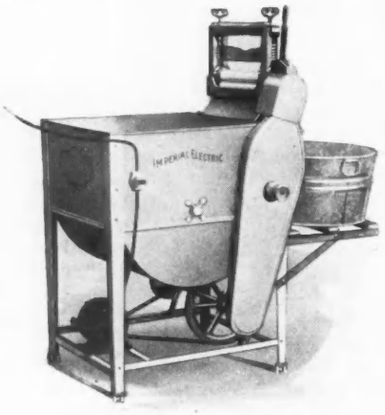
The advantage to the central station in having a thermostat which is adjustable only by a service man lies in the fact that a thermostat set at 180 deg. Fahr. will consume 15 per cent more energy per month than if set at 160 deg. Fahr. and 40 per cent more than if adjusted at 140 deg. Fahr. for the same monthly gallon consumption. It is at once evident, then, that a meter consumer complaining of high bills may be readily relieved by dispatching a service man to lower the adjustment of the thermostat. If the thermal storage capacity of the lower but more economical working temperature then proves inadequate and unsatisfactory, the consumer has the option of either again increasing his bill or increasing the capacity of his storage tank.

To accomplish with an immersion heater a temperature regulation approximating 100 per cent, the "Therm-Elect" unit has been designed to operate like an electric coffee percolator. The heater is tubular, with an opening along the side to permit the water to flow into the center of the heating unit, where it is rapidly heated and carried to the top of the unit with an increasing velocity, which is sufficient to project the hot water to the top of the boiler in the same manner as that by which a coffee percolator delivers hot water to the top of the pot. In Fig. 4 are shown load and temperature characteristics of the heater. The curves were plotted from observations taken from the twenty-four-hour operation of a 250-1500-watt thermally controlled immersion heater in a 30-gal. kitchen boiler.

The "Therm-Elect" heater may be operated on from 110 volts to 130 volts either alternating current or direct current. Where the domestic or commercial water-heating requirements necessitate the installation of a heater in excess of 1500 watts capacity, "Therm-Elect" equipment is made up for operation on 220-volt to 260-volt three-wire circuits, and the regulation is such as to maintain a perfect balance, it is pointed out, on the two sides of the three-wire system at all points between zero and full load.

Cylinder-Type Washing Machine

The Imperial Washing Machine Company of Sand Springs, Okla., announces the completion of its new 1917 model electric washing machine. Like the previous models, it is a cylinder-type machine, but has several new features through the use of which it is claimed that the time required to do a washing is cut down by one-half. The slots inside the cylinder are so arranged that they carry the water to the top of the cylinder and pour it into the clothes as they fall, thus forcing more water through the garments. Another new feature is the steel tub holder which can be folded against the wringer standard when not in use. Furthermore, the machine has many conveniences such as a reversing wringer, safety roll release, inclosed gears, special drain valve, special clutchless motor with adjustable base, two lids to



ELECTRIC CYLINDER WASHER

the cylinder, making it easy to clean without lifting out of place, etc. The machine is mounted in a structural-steel framework, and is equipped with a special pulley so that it may be driven by a gasoline engine without alteration, if so desired. A small pulley is also provided from which ice cream freezers or other small machinery may be driven from the same motor. It is made in two sizes for home and laundry use.

Talking-Machine Motor

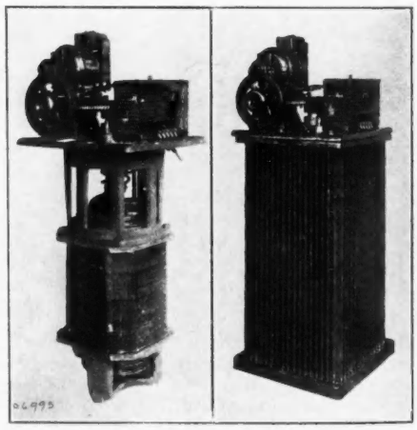
With the "Phonomotor" shown herewith any type of spring-operated phonograph using disk records can be made an electric-driven machine. The tiresome rewinding of the spring is eliminated and, according to the claims of the manufacturer, which is the Arnold Electric Company, Racine, Wis., the best reproduction possible of every record played is insured. The motor can be easily attached to any phonograph, by simply setting it alongside the metal disk of the machine so that the rubber pulley touches and drives the disk. Before installing the motor, the spring of the machine is allowed to run down entirely and the crank handle removed. No other changes are necessary. The regulating device is employed in the same way as when the spring is used. No harm can result to the machine, it is declared, and if it is desired not to use the motor, it is simply necessary to rewind the spring. The motor operates on either direct-

SMALL VERTICAL MOTOR INSTALLED ON DISK-TYPE TALKING-MACHINE

current or alternating-current at from 100 volts to 120 volts and may be used to operate other small mechanical models. The net weight of the device is 3 lb.

Induction Feeder Voltage Regulator

After a considerable amount of engineering and experimental work with a view to improving the electrical performance and mechanical details of its induction feeder voltage regulator, the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has placed on the market the new and improved type of feeder voltage regulator illustrated herewith. It is designed for single-phase 2300-volt, 60-cycle operation with 10-per cent regulation, and it is being made with ratings of from 5.75 kva. to 69 kva. The refinements secured in the new design, the maker states, have increased the reliability of the regulator in service and have simplified and decreased the expense of the



FIGS 1 AND 2—REGULATOR REMOVED FROM AND MOUNTED IN TANK

wiring necessary for installing accessories for automatic operation, in addition to improving the electrical efficiency. Figs. 1 and 2 show, respectively, the regulator removed from tank, and mounted in the tank.

The rotor is wound with form-wound coils, as shown in Fig. 3, and constitutes the primary element. The short-circuiting coils in the rotor are formed from a large number of turns of relatively small-size enamelled copper wire,

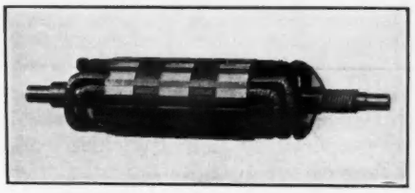


FIG. 3—ROTOR OF REGULATOR

thus reducing the watt loss in the windings without decreasing the neutralizing effect for which they are provided. The stator core with the secondary windings in place is shown in Fig. 4. The core is of the frameless construction so largely used in the construction of induction motors. With this form of construction the cross section of the stator core is increased without a corresponding increase in size of other parts and of floor space, resulting in a decrease of iron loss and exciting current. Furthermore, the insulating oil in which the regulator is immersed in the tank, comes in direct contact with all surfaces of the stator core.

In a regulator the insulation of windings is of vital importance because of the severe conditions of operation. The coils for both primary and secondary are therefore carefully insulated and impregnated, and are assembled in open slots. They are held by fiber wedges driven in small grooves at the top edges of the slots. Heavily insulated steel bracing rings are assembled around the exposed ends of the stator coils at both ends of the core. These rings are bound to the coils with cord and greatly stiffen the coils against distortion from mechanical shock caused by current surges in the feeder during periods of line disturbance or short circuit. This feature is an important one, increasing the protection to the coil insulation and the factor of safety of the regulator in service.

An electrically controlled switch or auxiliary relay for the operating mo-

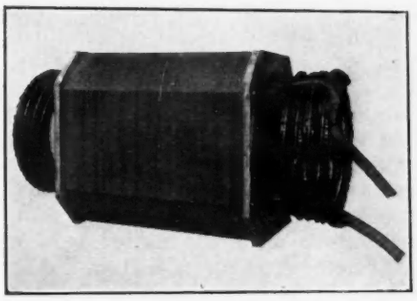


FIG. 4—STATOR CORE WITH SECONDARY WINDINGS

tor, formerly mounted separately from the regulator, is now mounted directly on the regulator top cover and includes the limit switch. This arrangement cuts down the number of wires required in the control circuit for automatic operation, and simplifies and lessens the expense of installation. The chance of failure in the control circuit is correspondingly lessened as well, and inspection of the wiring is made easy. The operating motor is provided with a quick-acting magnetic brake as heretofore, but the operating mechanism has been changed so that the regulator now requires only ten seconds for the complete range of travel from maximum buck to maximum boost, 20 per cent regulation.

Self-Starting Synchronous Motors

According to the Electric Machinery Company, Minneapolis, Minn., manufacturer of self-starting synchronous motors of the bracket, two-bearing pedes-

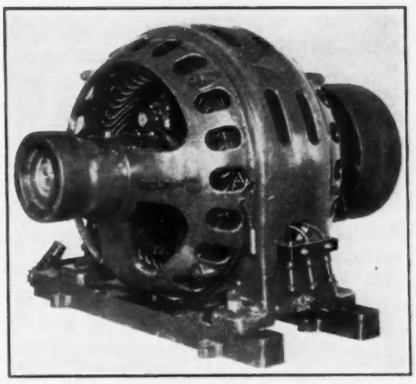


FIG. 1—SYNCHRONOUS MOTOR USED AS FREQUENCY CHANGER

tal and three-bearing pedestal types, and direct-connected generating units, the last few years have shown a tremendous increase in the use of synchronous motors. Synchronous motors are now being used, it is pointed out, for driving air compressors, refrigerating machines, etc., where they have the advantage of direct-connected motors mounted directly on the crankshaft, giving high efficiency and economy of floor space. The machines are also used to advantage for driving line shafts, either directly connected thereto or belted for operating rubber mills, flour mills, paper mills, stone-crushing plants, etc., and for direct connection to direct-current generators as motor generator sets; for direct connection to alternating-current generators as frequency changers and direct connection to centrifugal pumps, blowers, etc. The synchronous motors developed by this company are provided with a special type of rotor which gives them good self-starting characteristics, it is claimed, eliminating entirely the need of any external starting motor. The motors have a starting torque so high, the manufacturer declares, that they can be started readily even when carrying 50 per cent of their rated mechanical load.

The motors made by the Electrical Machinery Company are designed to start from rest without external assistance and have a starting torque of from 30 per cent to 50 per cent of full-load torque, while drawing from the line approximately full-load to two times full-load kva. They are also designed not to pull out of step when subjected to overload up to three or four times their full-load rating. The

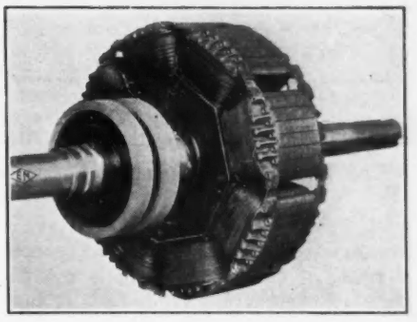


FIG. 2—ROTOR FOR SYNCHRONOUS MOTOR

motors are started directly from the primary line voltage through a starting compensator similar to that used with induction motors of corresponding rating. The larger sizes are usually equipped with a starting panel with instruments and switches in connection with an auto transformer.

Fixture for Living Room

A new design in living room fixtures which is rather a departure from existing designs is that recently brought out by the Beardslee Chandelier Manufacturing Company of Chicago, pictured herewith. The whole bottom piece is made in one casting of brass except for the ornamental pieces projecting from the bottom. Instead of the single large inverted bowl, it has five small inverted bowls of semi-opaque glass. It is a

ORNAMENTAL LIVING ROOM FIXTURE

classic piece adapted for use with modern furniture and would harmonize well with a Greek room. It may also be used as a dining room piece, although designed primarily for the living room.

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

American Industrial Commission to France

The American Industrial Commission organized under the auspices of the American Manufacturers' Export Association sailed from New York for France on the French line steamship Lafayette on Aug. 26. The purpose of the commission is not to take orders, but to make a scientific study of industrial conditions in France to determine the most advantageous method whereby American resources may be able to co-operate in the reconstruction that will follow the war. The project was suggested during the visit of the French commission to the United States during the winter of 1915-1916. On the day preceding the sailing E. M. Herr, president of the Westinghouse Electric & Manufacturing Company and also president of the American Manufacturers' Export Association, gave a luncheon to the members of the commission at the Hotel Biltmore.

In speaking of the plans of the commission, Chairman W. W. Nichols, who is assistant to the chairman of the Allis-Chalmers Manufacturing Company, stated that the commission would land in Bordeaux and work north, and probably finish the tour at Paris. A tentative itinerary has been submitted by the French government to cover twenty-one days, but Mr. Nichols believes that the commission could accomplish its purpose in less time.

"The French Chamber of Commerce, whose guests we shall be," he said, "intends to take us through the country. Whether or not we shall be able to attain what we hope to attain, I do not know. We hope to help solve the industrial problem of France. Her labor is being shot away in the war, and she must install labor-saving devices to keep step with the march of the industry. Europe has always been long on labor and short on machinery. After the war Europe will be short on labor and must adopt American industrial methods. We hope to plan for them industrial towns, as well as to show them new economies. The greatest thing of all will be the strengthening of the friendship between this country and France."

Dr. C. O. Mailloux, consulting engineer, New York City, who is one of the members of the commission, will be entrusted with the study of electrical conditions in France generally, and particularly that of electric traction.

Dallas Valuations

Indicating that, if all other points could be agreed upon, a valuation of $8,500,000 for the traction utilities of Dallas would be recommended to the citizens by the administration, Mayor Henry D. Lindsley and City Commissioners A. C. Cason and Manning B. Shannon have issued a statement to the public outlining their views upon the franchise situation. The administration has heretofore contended for a $7,100,000 valuation.

The administration, these three constituting the majority of the City Commission, sets forth that ultimately the settlement of the franchise issue will have to be submitted to the voters of Dallas, probably at the municipal election in April, 1917. Prior to that, however, the administration is willing to have taken a "straw vote" such as proposed by J. F. Strickland and C. W. Hobson, the heads of the reorganized companies planned to take over the light and traction interests respectively. In the event this "straw vote" should indicate that the majority of the voters of Dallas favor the settlement proposed by Messrs. Strickland and Hobson, upon an $8,500,000 valuation, then the administration would submit franchises based upon that valuation, to the voters for adoption or rejection.

Before the straw vote is taken there must be an agreement on two points: First, all details of the franchise must be agreed upon, and, second, an agreement must be had with the Northern Texas Traction Company over terms on which the Oak Cliff line will be acquired.

Value of Portland Company Properties

At a recent hearing in North Yakima, Wash., the case of that city against the Pacific Power & Light Company of Portland, Ore., was concluded before the Public Service Commission of Washington. Testimony given showed that the total value of the properties in the state had increased to $5,236,915 at the end of 1915. On this valuation, according to the testimony of the Public Service Commission accountant, the company's books showed a net return in 1915 of $435,876, and a similar return for the first six months of 1916 of $191,844. Reduced to the percentage basis, the accountant testified this is a 1915 return of 7.38 per cent, exclusive of depreciation. With an allowance of 1.55 per cent for depreciation, the minimum allowance suggested at prior hearings, the profit is cut to 5.83 per cent. The company contended that 2.5 per cent depreciation should be allowed, as is done at the Eugene, Ore., municipal plant. With this allowance the returns shrink to 4.88 per cent.

Profits for the first half of 1916 are less. J. E. Davidson, general manager of the company, testified that the bigger business comes in the second half of the year, but that the difference is not great. Without allowance for depreciation the 1916 profit stands at 6.36 per cent and with the maximum depreciation allowance at but 3.86, the return with a 1.5 per cent depreciation being 4.86 per cent.

Company officials state that the relatively poor showing in 1916 is due to the $60,000 expended in betterments, and because the heavy storms early in the year caused unusual operating expenses. No date for a final decision in the case was announced, although the commission expressed a desire to settle the matter as soon as possible. Unofficial comment on the case from Public Service Commission officials indicates that no further reduction in rates will be ordered. According to testimony by company officials the loss in revenue from residence, irrigation and power schedules, due to the change previously ordered by the commission, amounts to $31,386.

This last is estimated on the basis of 1913 business and shows a loss of $14,692 on residential rates and $16,676 on power schedules.

Cause of Death.—Evidence that deceased stood on one grounded guy wire, reached for a charged wire and fell and was killed, is insufficient to sustain a verdict that the fatal fall was due to touching the charged wire rather than through loss of balance, according to the Supreme Court of Oregon in the case of Medsker versus Portland Railway, Light & Power Company (156 P 272).

Contract Invalid Without Competitive Bidding.—A contract to furnish gas for municipal hospital, awarded without previous advertisement or competitive bidding, when there were competitive companies, is void, it was held by the Supreme Court of Pennsylvania (97 A 1083), though the other companies would have had to lay pipe some distance.

Assumption of Risk by Linemen.—The doctrine of duty of an employer to furnish safe places was held by the Court of Appeals of Kentucky (185 S. W. 817) in the case of Koch's Administratrix versus Louisville Gas & Electric Company to have no application in the case of a lineman on a pole killed by contact with a high-power wire, if he was not assured that the current was cut off; the place being, as he well knew, under those conditions naturally and intrinsically dangerous.

Right of Eminent Domain.—The Legislature cannot make a private use public by calling it so, so as to justify the exercise of the power of eminent domain in its behalf, it was held by the Supreme Court of Appeals of Virginia (89 S W 273). Although not forbidden by the Constitution, the Legislature cannot authorize the taking of private property for private use. A use to be public, to justify the exercise of the power of eminent domain, must be fixed and definite, and must be one in which the public as such has an interest, while the terms and manner of its enjoyment must be within the control of the state, independent of the rights of the private owner of the property appropriated.

Rights to Use of City Streets After Abandonment.—An act subjected electric light and power companies to "municipal control alone," and provided that no such company shall occupy the streets, alleys, etc., of any city, town or village, with its equipment to conduct electricity for lighting, heating, or power purposes without the "consent of such municipality." When such a company which has occupied the streets and public places of a city or village with its poles, wires and equipment, voluntarily and without the consent of the municipality removes and dismantles a portion of the same and renders itself wholly unable to furnish any electricity whatever for the purpose of public lighting, it cannot afterward return and repossess itself of those rights and erect another equipment in such streets and public places without the consent of the city or village, according to the Supreme Court of Ohio (113 N E 402) in the case of Hardin-Wyandot Lighting Company versus the Village of Upper Sandusky.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Wires Accessible to Boys.—A light and power company must use due care to prevent injury to children apt to come in contact with its wires in streets and alleys, the Springfield (Mo.) Court of Appeals (187 S W 556) held in the case of Williams versus Springfield Gas & Electric Company. Where the company's uninsulated wires were near a tree near a bungalow being built, it was not liable for injuries to boy, attempting to go from top of roof of house to top of tree and falling on such wires below.

Safe Place to Work for Line Men.—A telephone company is bound to inspect poles and lines and maintain them in a safe condition as to the public and employees, it was held by the Supreme Court of Pennsylvania (97 A 1038). A lineman does not assume the risk of injury from negligence of the company in failing to inspect the condition of its poles under ground. An employer is bound to furnish and maintain a reasonably safe place for its employees to work, and can neither shift the duty nor delegate it to another.

Contributory Negligence in Action by Line Man Against Lighting and Telephone Companies.—In an action by lineman of telephone company against that company and an electric light company for injury from a live wire of the latter company, caused by the negligence of both companies, evidence as to his previous experience and warnings, by appearance of wire and shouts of others before picking up the wire to make the street safe, held by the Texas Court of Civil Appeals (187 S W 234) to make the question of his contributory negligence for the jury.

License Fees for Poles.—Where the council required a license fee from all companies using wires and poles, amounting in gross to $4,700, and it was not shown what the inspection expense to the city would be, but the rate of tax was reduced after six months, the presumption would be that, if the receipts exceeded expenditures, the rate would be reduced, so that it was a police, and not a revenue measure, since an excess in one year was insufficient to show that it was a revenue measure, or unreasonable, according to the Supreme Court of Colorado (158 P 816). Since the ordinance of Colorado Springs exacting license fees of companies having poles and wires is prima facie valid, the unreasonableness of the exactions must be made clearly to appear, and they must be obviously and largely beyond what is needed for the purpose of inspection in order to render the ordinance void.

Legality of Minimum Charge. — A monthly charge to meter customers by an electric company of 25 cents "for service," in addition to charge for current used, does not violate the law, forbidding any one supplying gas, water, or electricity, by meter from charging for more than used as shown by meter, "provided the minimum charge contracted for with municipalities shall not be affected," since the charge is made, not "for electricity," but for the expense incident to maintaining the plant ready for customers' use at any time, and since the charge comes within the principle of a minimum charge, which is generally approved, it was held by the Supreme Court of Louisiana (72 S 428).

Franchise Qualifications and Conditions.—In an ordinance granting to an electric company the "right to manufacture and vend" electricity to the city and the citizens, "subject to the provisions and conditions hereinafter contained," which conditions were to furnish certain lights and not to erect an ice plant on a certain lot, it was not a "condition" that the company "manufacture" its own electricity rather than purchase it from another, since the grant should be construed according to the law, providing that the ordinary signification should be applied to words not technical, and since a condition ordinarily is any qualification, restriction, or limitation modifying or destroying the full enjoyment or use of a right, and under the maxim that the "expression of one thing is the exclusion of another," the word "manufacture" cannot be construed as more than mere description of the extent of the permit, it was held by the Court of Civil Appeals of Texas (1875 W 966) in the case which was brought by the City of Terrell against the Terrell Electric Light Company.

Liability for Flowage.—The owner of land abutting upon a lake or stream is entitled to have the water maintained at the natural and ordinary level at all times, it was held by the Supreme Court of Minnesota (158 N W 979) in a case against the Minnesota & Ontario Power Company. Congress authorized the raising of the water to the point to which it was raised, but this does not relieve the dam owner from liability, since the legislation provided that it did not relieve against liability for damage to private property. The legislation of Congress did not grant any right of flowage of land now privately owned, but which at the time of its enactment was government land. The fact that one corporation owns all the stock of another does not make them the same, nor does it pass to one the property of the other, nor render one liable for the acts of the other. Still one corporation may be the agent of another. The facts in evidence, taken all together, are sufficient to sustain a finding that the Rainy River Improvement Company, which built and operates the dam, is a mere agency of the defendant, for the benefit of whose property and business the dam was constructed and is operated the court held.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Plan to Light Harvard Stadium.—The Harvard athletic authorities are seriously considering the installation of a lighting system which will make the Stadium available for late afternoon and evening football practice, and also make it possible to play longer periods in the October games without encountering total darkness. Boston Edison engineers are working on the problem.

May Flood Light Monument at Intersection of National Highways.—A committee has been appointed of which T. P. Riddle of Lima, Ohio, is chairman, to investigate and recommend a type of tower or monument to designate the junction of the Lincoln Highway and the Dixie Highway, which cross each other in the public square of Lima. It is probable that this monument will be flood lighted.

Electrical Service Campaign.—The Willapa Electric Company, Raymond, Wash., has inaugurated what it terms an "Electrical Service Campaign." The campaign is held under the supervision of an electrical expert who calls on all the homes in the city, and electrical troubles are carefully investigated and new devices introduced and demonstrated. The company states the campaign will continue for a period of three weeks.

Kansas City Boosts Electricity as Gas Substitute.—Kansas City residents both in Missouri and in Kansas, are much concerned over the fuel prospect for this winter, with coal prices rising and a shortage threatened and with a prospect that natural gas from the Kansas and Oklahoma fields will be raised in price practically to 50 cents per 1000 ft., with little gas at that. In view of this situation, the light department of Kansas City, Kan., is exploiting electricity as the cooking fuel of the future, and the Electric Shop of Kansas City, Mo., is selling an unprecedented number of grills.

A Variable Self and Mutual Inductor.—The Bureau of Standards has just published a paper which describes a new form of instrument for varying self-inductance. It consists of two sets of coils of insulated wire mounted in circular hard rubber plates between which a similar plate carrying two coils is arranged to turn, thus varying the inductance. Diagrams and data are given from which instruments of this type may be designed to meet the requirements of a given use. Comparison is made of the new instrument and of older ones. Copies of this report, scientific paper No. 290, may be obtained without charge upon application to the Bureau of Standards, Washington, D. C.

Protecting Crossings Against Floods.—Work of putting in crossings over the streams subject to severe floods in the winter season has been commenced by the Pacific Light & Power Company, of Los Angeles, Cal. These crossings will be constructed by the erection of high and substantial standards on either side of the streams to carry the wires across entirely clear. Heretofore much interruption has been caused by the erection of standards in the stream beds, flood waters washing them out frequently.

Cleveland Plant Wants Power Load.—Commissioner Davis has announced that if the city is not awarded the contract for furnishing energy to the Cleveland Railway Company, to take the place of that furnished by the Cedar Avenue power house, he will endeavor to have a substation located under a portion of the public square, so that the plant may seek power business in the downtown section. The city will endeavor to have a bond issue of $1,750,000 approved by the voters, so that the municipal plant may be enlarged. The railway company has asked the city to bid on a contract for furnishing energy.

A System of Remote Control for an Electric Testing Laboratory.—In a laboratory in which a large number and variety of electrical instruments are tested, it is important that means be provided for the rapid and accurate control of the electric generators which provide the current for testing. In scientific paper No. 291 by P. G. Agnew, W. H. Stannard and J. L. Fearing, published by the Bureau of Standards, an elaborate system of this kind which is in use at the bureau is described. The control rheostats are not handled by the observers directly, but are operated by small motors which are controlled from any one of several laboratory rooms by means of small, multiple lever switches. Copies of this report may be obtained without charge upon application to the Bureau of Standards, Washington, D. C.

Texas May Have Power Districts.—C. M. Cureton, assistant attorney general of Texas, is leading a movement to bring about the enactment of a law that will authorize the formation of public utility districts and the issuing of bonds, the proceeds to be used in the construction of electric generating plants and the building of transmission lines for providing power for operating machinery upon the farms that are embraced in the respective districts. It is stated by Mr. Cureton that by forming power districts under the plan proposed farmers would be able to obtain their power for pumping and a variety of other purposes at nominal cost. This public utility district plan is of the same character as that which is now in effect in Texas as to community irrigation, drainage and levee projects. The districts will be bonded upon a valuation of the land embraced therein, and the proceeds from the sale of the bonds will be used for the construction of the power plants, transmission lines and other necessary equipment.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Will Entertain Jobbers at Cleveland.—President N. H. Boynton of the Cleveland Electrical League has appointed the following committee to look after the entertainment of the electric jobbers, who will hold a convention in Cleveland on Oct. 20: J. F. Kerlin, chairman; J. M. Bateman, G. S. Milner, Louis Griesser and W. G. McKitterick.

Indiana Electric Light Association.—The following papers have been arranged for presentation at the annual convention of this association to be held at the Anthony Hotel, Fort Wayne, Ind., on Sept. 12, 13 and 14. Address of the president, by E. J. Condon; "Financing Public Utilities," by A. R. Holliday; "Pole Line Construction," by G. L. Lindsley; "Farm, Rural Business and County Road Lighting," by G. K. Wilson; "Management of Public Utilities," by T. F. English; "Industrial Power," by George R. Seeger; "Maximum Demand Rates and Cost of Service," by Emmett Ralston; "Voltage Standardization," by M. D. Cooper; an address by Thomas Duncan, chairman Public Service Commission, subject to be selected; "Why the Electric Range Has Come to Stay," by R. A. MacGregor; "The Spark Plug of Electrical Industry," by C. B. Hart; "Developing Central Station Motor Loads," by W. H. Patterson; "Inductive Interference and State Regulation of Pole Lines," by E. J. Condon; "Safety Code," by H. E. Goheen, Bureau of Standards.

International Association of Municipal Electricians.—The following have been elected officers of the International Association of Municipal Electricians at the convention held in Baltimore, last week: President, Robert J. Gaskill, Fort Wayne, Ind.; first vice-president, Dr. Charles P. Steinmetz, Schenectady, N. Y.; second vice-president C. E. Convers, San Antonio, Tex.; third vice-president, John H. Thomas, Scranton, Pa.; fourth vice-president, John W. Black, Little Rock, Ark.; secretary, Clarence R. George, Houston, Tex.; treasurer, C. E. Diehl, Harrisburg, Pa. W. H. Flandreau, Mount Vernon, N. Y., the retiring president, was elected chairman of the executive committee. The others elected as members of the committee are R. E. Moran, Memphis, Tenn.; Z. Morrison, Minneapolis, Minn.; Jacob Grimm, Buffalo, N. Y.; George E. A. Fairley, Baltimore; W. L. Potts, Detroit, Mich.; Frank Brooks, Indianapolis, Ind.; Jay B. Frank, Perth Amboy, N. J., and C. S. Downs, Altoona, Pa. The finance committee consists of W. Arbuckle, Bayonne, N. J.; Charles F. Gall, Louisville Ky., and W. J. Beisel, Allentown, Pa. Niagara Falls was selected for the next convention.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

WASHING MACHINE SALES

The Volume of Business Is Now Large with Excellent Prospects for the Future

Sales of electric washing machines are larger now than ever before. Various estimates have been made by manufacturers but on the whole the trade is turning out probably 50 per cent more machines this year than last. Many factors have entered to make this volume of business. General prosperity has probably been the most dominant feature, although it is undoubtedly true that the desire for the machine in most instances was created long before.

Central stations by offering machines on a time payment basis have opened up a field that it is certain could be reached in no other way. Electric washing machines, because of their construction and equipment, are naturally expensive and if purchased outright would necessitate the outlay of what would look like a very large sum of money to the average family. Families, however, with a comfortable and steady income find no financial uneasiness in paying a fixed sum every month for a number of months.

One manufacturer points out that in some instances sales have been made owing to the scarcity of domestic help. Labor shortage and record business have opened to female labor new opportunities in the industrial field.

Prices have not been advanced on all makes of washing machines although labor and materials have increased costs sufficiently to warrant a general advance. In those instances where advances have been made, the new price is but little greater. It is the intention of the manufacturers as far as possible to make up increased production cost in volume of production.

By maintaining a large stock it has been possible for a large number of producers to make quick deliveries. Others have made fair deliveries. All producers have been kept back in production by raw materials and by motors. It has been very difficult to obtain a sufficient supply of the latter.

Credits and collections are quite satisfactory.

Judging the market from the present rate of orders manufacturers are inclined to be decidedly optimistic about the future. Sales of still greater volume are predicted.

JUNE ELECTRICAL EXPORTS LARGE

Fiscal Year Ended June 30, 1916, Largest Twelve Months on Record—Total for Period $30,254,020

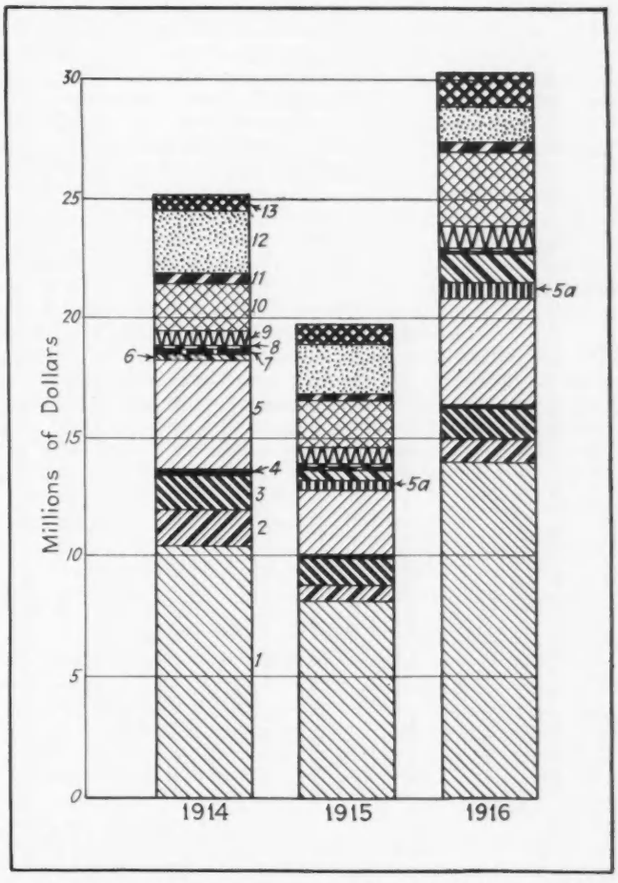
Next to the month of May, 1916, June last stands out as the largest electrical export month in the history of American shipping. During the month electrical goods of American manufacture to a total value of $3,150,144 were sent to foreign ports. This figure is to be compared with $2,047,081 exported during June, 1915. The increase is 54 per cent.

June was on the whole what might be called a good average month. While there were no records broken, with the exception of miscellaneous articles, which jumped ahead of all previous months in the current year, the values in the separate classes were high.

Generator exports, while but $5,000 less than the high mark for the year registered in April, were $45,000 less than during June, 1915, when $191,464 worth of American-made generators were shipped out of the United States. Fan, interior wiring supplies and fixtures, arc-lamp and carbon-lamp exports were also less in June last than in the preceding June. The exports of arc lamps had dropped to the surprisingly low figure of $156.

June completes the fiscal year of the Bureau of Foreign and Domestic Commerce, from which these figures were obtained. During the fiscal year just ended the exports of electrical goods were larger than for any previous twelve-month period. They amounted to $30,254,020 as compared with $19,771,757 for the year ended June 30, 1915, and $25,060,844 for the preceding twelve months.

Looking over the exports for the last three fiscal years certain facts stand out prominently. The battery export trade has grown rapidly, more than doubling in two years, while the foreign demand for American generators is apparently decreasing as rapidly. Exports of generators during the year ended June 30, 1914, were $2,634,365; the next twelve months $2,013,130; and in this last fiscal year



ELECTRICAL EXPORTS BY ARTICLES IN 1914, 1915 AND 1916

(1) Miscellaneous, (2) transformer, (3) telephones, (4) telegraph instruments, (5) motors, [5(a)] meters, (6) tungsten lamps, (7) carbon lamps, (8) arc lamps, (9) interior wiring supplies, (10) insulated wire, (11) fans, (12) generators, (13) batteries.

$1,468,961. The fan trade seems to have recovered considerably from its 1915 slump and apparently is in a strong position.

Exports of insulated wire and cables stood about the same for the 1914 and 1915 periods but took a tremendous spurt in the fiscal year just ended. Copper, however, had doubled in price, necessitating a proportionate increase in the price of wire and cable, which would not only account for the apparent increase in wire and cable exports but would serve to indicate that perhaps there was a decrease in actual volume of goods.

Arc-lamp exports have been growing less and less. Carbon lamps, strangely enough, whether because of ready stock or price concessions, were larger in the twelve months ended June 30, 1916, than in the preceding year.

Of all electrical exports that of metal filament lamps has in point of percentage of growth been the most remarkable, due to the fact that Germany had previously supplied lamps of this type to England and France. Exports in this class jumped from $219,439 in the twelve months ended June 30, 1914, to $473,149 in the next year and to $1,282,039 in the year ended June 30, 1916. Meter exports in the last fiscal year were almost double what they were in the year previous, the first year they were listed separately.

Motors, which have always been the largest individual item in electrical exports, had recovered from the 1915 depression and were being exported almost as much in the year just ended as in the record months of 1913-1914. Exports of telegraph instruments, telephones and transformers were also recovering, the last the slowest of all. Miscellaneous equipment to the value of $13,970,236 was exported in 1915-1916 fiscal year as compared with $8,152,141 and $10,440,114 in the two preceding years respectively.

Electrical exports for the first half of 1916 amounted to $17,364,230 as compared with $11,024,141 for the first six months of 1915. At this rate 1916 electrical exports should come close to touching the $35,000,000 mark.

As the ELECTRICAL WORLD has been pointing out in previous analyses of the monthly electrical exports, present figures are not to be strictly compared with figures of a year ago. Values only are represented and not volume of goods. Inflated prices of the present have practically destroyed the comparative value of trade figures.

EXPORTS OF ELECTRICAL GOODS OF AMERICAN MANUFACTURE

Articles	June		Twelve Months Ended June		
	1915	1916	1914	1915	1916
Batteries	$113,950	$159,876	$685,640	$967,146	$1,569,836
Dynamos or generators	191,464	145,965	2,634,365	2,013,130	1,468,961
Fans	48,106	24,831	432,656	258,309	356,729
Insulated wire and cables	253,247	290,151	1,992,304	1,911,850	3,157,239
Interior wiring supplies, etc., including fixtures	70,915	36,835	721,069	753,351	818,985
Arc lamps	1,826	156	76,766	30,984	18,693
Carbon filament lamps	11,432	4,188	172,064	101,923	144,872
Metal filament lamps	78,536	133,683	219,439	473,149	1,282,039
Meters and other measuring instruments	41,214	72,540	.....	440,916	776,381
Motors	283,923	321,147	4,541,541	2,818,743	4,218,974
Telegraph instruments (including wireless apparatus)	1,522	8,564	136,592	76,271	148,536
Telephones	44,342	183,965	1,552,951	1,149,361	1,329,346
Transformers	70,543	55,847	1,455,343	624,483	993,193
All other	836,061	1,712,396	10,440,114	8,152,141	13,970,236
Total	$2,047,081	$3,150,144	$25,060,844	$19,771,757	$30,254,020

HEATING DEVICE LICENSES

Manufacturers Permitted to Make Appliances Under Different Forms of Licenses

As joint owners of the Marsh patent, No. 811,859, for nickel-chromium wire as a resistance unit, the General Electric Company and the Hoskins Manufacturing Company have granted a number of licenses to other manufacturers of heating devices. They also contemplate, it is understood, granting certain licenses to manufacturers of rheostats.

Licenses to manufacture the wire are held by the Hoskins Manufacturing Company, Detroit, Mich., The Driver Harris Wire Company, Harrison, N. J., and the Electrical Alloy Company, Morristown, N. J. These manufacturers are the only ones to produce the wire sheet or rod from which the heating elements are made. They are licensed to sell this material to be used in accordance with the patents under which the license is granted only to licensees holding licenses to manufacture the resistance elements in question.

Licenses for device manufacturers are of three forms.

Form 1 license is a general license to manufacture, use and sell heating devices under the patents in question. Licenses of this form have been granted so far to nine of the more important heating device manufacturers.

Form 2 license is restricted to the manufacture of heating devices from heating units purchased from other licensees. The licensee is not licensed to make his own heating units. It is also in general restricted both in scope and quantity, as for example a Form 2 licensee may be licensed to manufacture and sell $10,000 worth of flatirons during 1916.

Form 3 license differs from Form 2 license in that the licensee is licensed to make his own units, but contains in general the same quantity and scope restriction.

In granting these licenses it has, in general, been the policy of the licensor to grant Form 2 to those who have been buying units from others for incorporation into articles of their manufacture, and to grant Form 3 to those who have been manufacturing their own devices.

It has been usual in adjusting the scope limitation to allow the licensee to manufacture devices which he has been manufacturing and the quantity limitation has been used rather generally in Forms 2 and 3 to prevent an indefinite extension of business by a particular licensee in cases where the devices under consideration were not in any sense new devices in the art, or did not in any way extend the field of the heating industry.

Special licenses have been granted to a few manufacturers and in each case are limited in their duration.

A complete list of the licensees to date groped according to the form of license follows:

FORM NO. 1 LICENSEES.

American Electric Heater Company, Detroit, Mich.
Cutler-Hammer Manufacturing Company, New York City.
Copeman Stove Company, Flint, Mich.
General Electric Company, Schenectady, N. Y.
Hotpoint Electric Heating Company, Ontario, Cal.
Hughes Electric Heating Company, Chicago, Ill.
Landers, Frary & Clarke, New Britain, Conn.
Pelouze Manufacturing Company, Chicago, Ill.
Simplex Electric Heating Company, Cambridge, Mass.

FORM NO. 2 LICENSEES.

American Metal Ware Company, Chicago, Ill.
American Stove Company, St. Louis, Mo.
Birtman Electric Company, Chicago, Ill.
Charter Oak Manufacturing Company, St. Louis, Mo.
Crystal Percolator Company, New York City.
Detroit Electric Branding Iron Company, Detroit, Mich.
Electric Specialty Manufacturing Company, Benton Harbor, Mich.
Rathbone Sard Company, Albany, N. Y.
Rochester Stamping Company, Rochester, N. Y.
E. H. Sargent & Company, Chicago, Ill.
Standard Electric Stove Company, Toledo, O.
Van Briggle Tile & Pottery Company, Colorado Springs, Col.

FORM NO. 3 LICENSEES.

American Sterlizer Company, Erie, Pa.
Arnold Electric Company, Racine, Wis.
Automobile Supply Company, Brooklyn, N. Y.
Frank S. Betz Company, Hammond, Ind.
The Bigelow Company, Chicago, Ill.
Boston Hospital Supply Company, South Acton, Mass.
Buffalo Manufacturing Company, Buffalo, N. Y.
Burke Engineering Company, Reading, Pa.
Caloric Electric Company, Janesville, Wis.
Central Scientific Company, Chicago, Ill.
Chicago Flexible Shaft Company, Chicago, Ill.
Clark Electric Heater Company, Sheridan, Wyo.
William H. Dalton Company, Salem, Mass.
Detroit Stove Works, Detroit, Mich.
DeVilbiss Manufacturing Company, Toledo, O.
E. H. Duncan Company, Dunkirk, N. Y.
Eberbach & Son Company, Ann Arbor, Mich.
Electric Sales Corporation, Seattle, Wash.
Endicott Johnson Company, Johnson City, N. Y.
Faultless Carbureter Company, Mason City, Ia.
P. A. Gier Company, Cleveland, O.
Globe Stove & Range Company, Kokomo, Ind.
The Gorham Company, Providence, R. I.
Gwynn Bacon Vulcanizing Company, St. Louis, Mo.
The Halverson Company, Portland, Ore.
Carl I. Hayes, Edgewood, R. I.
Hamilton Beach Manufacturing Company, Racine, Wis.
Holcombe & Hoke Manufacturing Company, Indianapolis, Ind.
Konsrv Electric Company, Cleveland, O.
Lincoln Electric Works, Chicago, Ill.
Lindstrom Smith & Company, Chicago, Ill.
Loetscher Ryan Company, Dubuque, Ia.
Majestic Electrical Devices Company, San Francisco, Cal.
Metal Specialty Manufacturing Company, Chicago, Ill.
Miller Manufacturing Company, Globeville, Mich.
Millner Electric Manufacturing Company, St. Louis, Mo.
National Electric Utilities Company, New York City.
C. Nestle Company, New York City.

Onlysafe Electric Manufacturing Company, Dorchester, Mass.
Perfection Hat Conformator Company, Chicago, Ill.
Pfanstiehl Company, North Chicago, Ill.
Premier Electric Company, Chicago, Ill.
Quick Electric Heater Company, Cincinnati, O.
Redtop Electric Company, New York City.
Ritter Dental Manufacturing Company, Rochester, N. Y.
Rutenber Electric Company, Marion, Ind.
E. H. Sargent & Company, Chicago, Ill.
H. W. Schwimmer Manufacturing Company, Indianapolis, Ind.
Sheffield Car Company, Three Rivers, Mich.
Simplex Wrapping Machine Company, Fulton, N. Y.
William G. Slaughter Company, Chicago, Ill.
Southern Cotton Oil Company, Savannah, Ga.
Standard Electric Stove Company, Toledo, O.
Standard Stamping Company, Marysville, O.
Stoneware Electric Stove Company, Dover, N. J.
Townsend Grace Company, Baltimore, Md.
Waage Electric Company, Chicago, Ill.
Weco Manufacturing Company, Boston, Mass.
A. C. Williams Company, Ravenna, O.
Wilmot Castle Company, Rochester, N. Y.
Max Wocher & Son Company, Cincinnati, O.
Woldenberg & Schaar, Chicago, Ill.
Wood, Nathan & Virkus Company, New York City.
Wrapper Sealing Machine Company, Janesville, Wis.

SPECIAL LICENSEES.

Cadillac Electric Manufacturing Company, Cadillac, Mich.
George W. Cann Company, Logansport, Ind.
S. Sternau & Company, New York City.

ELECTRIC RANGE ADVERTISING

Manufacturers Decide for the Present Against National Co-operative Campaign

Manufacturers of electric ranges, it is understood, have decided, for the present at least, against a national co-operative advertising campaign. They have agreed to incorporate in all of their newspaper and magazine advertising of electric ranges, as a leader, general advertising showing the advantages of electric cooking, following this with advertising of their own range; assigning approximately 60 per cent of the space used to general advertising and the balance to the advertising of their own range. It is generally conceded by all interested that for the most part the electric range game is still in the exploitation period, and that consequently advertising, generally, must be more of an educational than of a sales-building type.

Manufacturing and Industrial

The Crocker-Wheeler Company, Ampere, N. J., has moved its San Francisco district office from the Crossley Building, 619 Mission Street, to the ground floor of 87 New Montgomery Street. W. K. Brown is district manager of this office.

The Trumbull Electric Manufacturing Company, Plainville, Conn., has appointed George P. Flading manager of its New York office. Mr. Flading has been salesman for the company in its Eastern territory for nine years and his experience in marketing the company's products has therefore been very broad.

Prices of Hotpoint Appliances Advanced.—The Hotpoint Electric Heating Company, Ontario, Cal., announces that from Sept. 1 advances in the prices of the following appliances will be made: Rectangular grill, 4-in. stove, 6-in. stove, 3000-watt air heater, 1800-watt radiant heater and 3000-watt radiant heater. The increase in prices has been brought about by the rapidly advancing cost of raw material.

Carson & Evans, 3 Fenchurch Buildings, London, E. C., England, who are large wholesale buyers of electrical material, particularly such things as small switches and other types of turned and molded goods, announce that they would like to get in touch with large American manufacturing companies. The concern would also like to have various manufacturers send copies of price lists and best wholesale and shipping terms for export.

"Big Drive" of American Ever-Ready Works.—The American Ever-Ready Works of Long Island City, N. Y., is planning a publicity campaign which it is terming the "Big Drive," which is to be pushed throughout the United States, Canada and all outlying districts reached by American publications. The results from the 1915 fall campaign from both dealer and the public were so great that the company has decided to go after the market in a new and bigger way. The company is seeking a new word to take the place of "flashlight," attractive window displays and stories telling how "Ever-Ready" flashlamps were sold.

Electromotor, S. A., of 43 Avenue Isabel La Catolica, Mexico City, Mexico, informs the ELECTRICAL WORLD that it would like to hear from various American manufacturers in regard to agencies for handling electrical appliances such as heating devices, insulators, house-lighting fixtures, glassware, lamps and machinery. The concern is an importer of electrical appliances and machinery and maintains showrooms and a retail store in the business district of Mexico City. It does an important wholesale business with railroads, mines and haciendas and in normal times covers the entire republic with a sales force.

The Ohio Storage Battery Company has been incorporated with a capital stock of $20,000 to take over the business of the Columbus Storage Battery Company, Columbus, Ohio, distributor of National Carbon products for central and western Ohio. The officers of the company are as follows: President and sales manager, C. H. Lee, Jr.; vice-president, J. C. Langley; treasurer and general manager, J. A. Weston; superintendent of service, J. W. Collins. F. H. Sonner will have charge of a branch salesroom and service station at Cincinnati and J. C. Langley will manage another branch at Dayton, Ohio.

Silk Manufacture at Electrical Exposition.—One of the features of the 1916 Electrical Exposition which will be held in the Grand Central Palace, New York, Oct. 11-21, will be an exhibit of the manufacture of silk showing practically every process from the silk worm to the finished gown. The various processes of "throwing," "unskeining," "spooling" and "weaving" will be shown. The silken fabric will then be made into gowns which will be worn by models who will walk about the various floors of the exposition building. H. R. Mallinson of 251 Fourth Avenue, New York City, manufacturer of silks, will supply all the equipment and machinery for the exhibit. The looms and other machinery are being especially nickel-plated for the exposition and motor drive will be used throughout.

The Standard Woven Fabric Company, which recently removed to Walpole, Mass., has sold its plant at Framingham, Mass., and it is to be occupied by the Bela Body Company of Amesbury, which will operate the whole property for the production of automobile bodies. The main building is of modern concrete construction, 53 ft. by 224 ft., three stories high, having about 40,000 ft. of manufacturing space, and an attached fireproof boiler house, all equipped with sprinkler system and other modern conveniences. There is 103,720 ft. of land bordering on the railroad. Town assessment places $45,550 on the building and $7,570 on the land, making a total of $51,120. Joseph P. Day of New York represented the grantor and The Factory Exchange of Boston acted as broker for the purchaser.

Recent Electric Truck Orders to General Vehicle Company from Brewers.—The General Vehicle Company has recently received the following orders from brewers for electric trucks: The Brand Brewing Company, Toledo, one five-ton truck; the Manhattan Brewing Company, Chicago, two five-ton trucks, making ten in all; Dick Brothers, Quincy Brewing Company, Quincy, Ill., one two-ton truck; George Ehret, New York City, ten five-ton trucks, making over 100 in all; the Anheuser-Busch Brewing Association, Chicago, five three-and-one-half-ton and two two-ton trucks; Beadleston & Woerz, New York City, two trucks, making thirty-two in all; Andrew Erdrich & Son, Philadelphia, one truck, making eleven in all; E. & J. Burke, New York City, one five-ton truck, making three in all; William A. Miles & Company, New York City, one truck; and Jacob Ruppert, Inc., New York City, eleven five-ton trucks, making over 150 in all.

The Cutler-Hammer Manufacturing Company of Milwaukee, Wis., has inaugurated a nation-wide publicity campaign for pushing its push socket. The following slogan has been adopted: "Making the C-H Push Socket the Lamp Socket of the Country." Although this campaign was planned some time ago, it was held up purposely to make sure that there would be a perfect trade distribution of sockets in all parts of the country, so that the company as well as those

handling or installing the sockets would receive the fullest benefit from the campaign from its very start. The capacity for turning out these push sockets has been doubled twice in the past two years, the company announces. In connection with the campaign, large display advertisements in various trade journals and popular magazines will be utilized.

NEW YORK METAL MARKET PRICES

	Aug. 22 Selling Prices Bid	Aug. 22 Selling Prices Asked	Aug. 29 Selling Prices Bid	Aug. 29 Selling Prices Asked
Copper	£ s d	£ s d	£ s d	£ s d
London, standard spot	110 10 0		110 0 0	
Prime Lake	27.00	to 27.50†	27.00	to 27.50†
Electrolytic	27.75	to 28.00†	27.75	to 28.00†
Casting	24.87½	to 25.12½†	25.00	to 25.25†
Copper wire	32.50†		33.00†	
Lead	6.50		6.50	
Nickel	45.00	to 50.00	45.00	to 50.00
Sheet zinc, f.o.b. smelter	15.00†		15.00†	
Spelter	9.67½	to 9.92½	8.92½	to 9.17½
Tin, straits	38.45		39.37½	
Aluminum, 98 to 99 per cent	56.00	to 58.00†	58.00	to 60.00†

OLD METALS

Heavy copper and wire	21.50 to 22.00†	22.00 to 22.50†
Brass, heavy	12.75 to 13.00†	13.00 to 13.25†
Brass, light	9.50 to 10.00†	9.75 to 10.25†
Lead, heavy	5.50 to 5.62½†	5.50 to 5.62½†
Zinc, scrap	6.25 to 6.50†	6.50 to 6.75†

COPPER EXPORTS

Total tons to 27,635

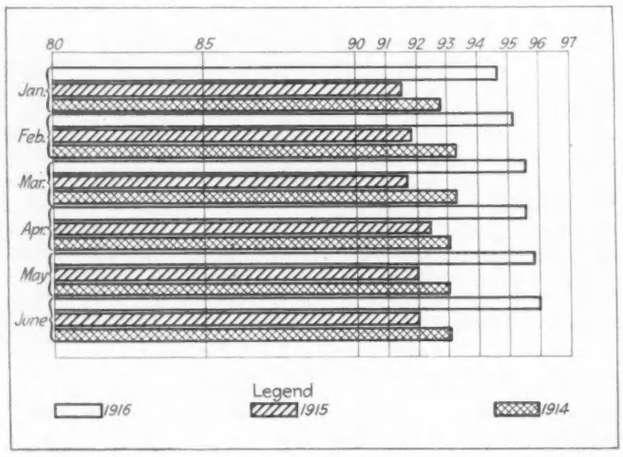
†Nominal.

HIGHER BOND PRICES

Average Price of Ninety-six Light and Power Utility Bonds for First Half of 1916 Over 95

Utility bonds are fast becoming recognized as being one of the safest investments. Banks annually place a larger proportion of their invested funds in utility securities. With regulation and sane policies of management unwarranted financing has been wiped out, and public utility securities now represent as far as possible actual values.

As evidence of the confidence this new order of affairs



TREND OF ELECTRIC LIGHT AND POWER UTILITY BOND PRICES DURING FIRST SIX MONTHS OF 1914, 1915 AND 1916

has given to investors, the ELECTRICAL WORLD presents the accompanying graphical analysis of monthly bond prices of ninety-six representative electric light and power company bonds. These are for the most part first mortgage bonds. The prices were taken from quotations of exchanges all over the country and represent as nearly as possible the bond prices on the last business day of the month. The chart shows for purposes of comparison the average monthly price for the first six months of 1914, 1915 and 1916. The total par value of the bonds represented and that are now outstanding is more than $375,000 000. This is roughly 36 per cent of the aggregate par value of all American light and power utility bonds.

In the first half of 1914 the average monthly prices varied but little from 93. Whatever fluctuation there were was slight, and furthermore occurred mostly in a few particular bonds. During the first half of 1915 the average price was around 92, opening at 91.5 in January, reaching 92.4 in April and closing at 92.0 in June. Prices continued on this level until October, 1915, when there was a decided tendency toward better prices. Up to that time there had been plenty of money but little buying, probably because of industrial inactivity. In the fall of 1915, public utility bonds and especially those in the light and power field came greatly into demand. It was quite common for members of a syndicate formed to purchase an issue never to see a bond of that issue. Issues bought one day were sold the next, and in some cases investors had bid on whole issues long before the issue had received the approval of the public service commission.

Naturally utility bond prices advanced. For January last the average price was 94.7. This price advanced monthly through the successive values of 95.1, 95.6, 95.6, 95.8, until the month of June, when the record price of 96 was reached.

Corporate and Financial

Milford (Mass.) Electric Light & Power Company.—The Massachusetts Board of Gas and Electric Light Commissioners has approved the issue of additional capital stock, amounting to $62,000, for the payment of a floating indebtedness of the company incurred in additions to its plant and distributing system, and further proposed additions thereto.

Northern Ohio Traction & Light Company, Akron, Ohio.—Official announcement has been made in Cleveland of the closing of negotiations for control of the company's common stock. Hodenpyl, Hardy & Company of New York and E. W. Clark & Company of Philadelphia will take over the stock at par or $100 a share contingent upon not less than 95 per cent of the stock being deposited for sale. As yet no announcement has been made whether or not Northern Ohio will be included in the Commonwealth Power Railway & Light properties, but it is probable it will be taken over by that corporation. In connection with the announcement of the sale, E. W. Moore, vice-president of the Northern Ohio Company, said: "A contract has been entered into between holders of Northern Ohio Traction & Light Company common stock, aggregating a majority for the sale of the stock with the understanding that all holders of common stock may participate on exactly the same price and terms. The price is par, and the dividend payable Sept. 15 will go to present holders. The sale is contingent upon 95 per cent of all of the stock coming in. Notices are being mailed requesting deposit of the stock with the Citizens Saving & Trust Company as trustees. The bank will issue participating certificates. The terms are $3 a share, to be paid on notice by the trustee that 95 per cent of the stock is on deposit; $47 a share payable thirty days later and the remaining $50 a share to be paid on or before one year later at 6 per cent interest, payable quarterly. The trust company certificates will have all of the stock so purchased as security. They will be in negotiable form and usable in place of stock. Possession of the property will not be turned over to the buyers until a full 50 per cent has been paid."

Potomac Light & Power Company, Martinsburg, W. Va.—This company, which purchased the plant and equipment of the Martinsburg Power Company, held its first stockholders' meeting recently in Baltimore, when the following officers were elected: President, E. L. Coblentz; vice-president, J. L. Hook; secretary, E. J. Wade; treasurer, Dr. S. N. Myers.

Sheboygan Electric Company.—The Wisconsin Railroad Commission has granted permission to the company to issue $200,000 in common stock, $350,000 in preferred stock and $1,550,000 in bonds. The proceeds are to be used to retire the stock of the old Sheboygan Railway & Electric Company and for additions and extensions.

St. Joseph (Mo.) Railway, Light, Heat & Power Company.—The company has called a meeting for Sept. 28 to au-

thorize the creation of a new first and refunding mortgage securing $15,000,000 5 per cent thirty-year bonds. The new bonds will be used for the purpose of refunding $5,000,000 first mortgage bonds now outstanding, and $326,000 first mortgage bonds of the St. Joseph & Savannah Interurban Railroad Company. The balance of the new issue will be used in future requirements of the company for extensions, betterments and other improvements. The stockholders will also be asked to approve the extension of the new mortgage to the properties of the St. Joseph & Savannah, as well as on all properties of the St. Joseph Railway, Light, Heat & Power Company.

New Utility and Industrial Companies

The Fornes-Walters Electric Company of Canton, Ohio, has been incorporated for $10,000. George F. Fornes is president.

The Lee Light & Power Company of Clarinda, Iowa, has been incorporated in West Virginia. Rufus E. Lee is secretary of the company. The capital stock is $633,008.26.

The Kent Light & Power Company, Hanover, Ind., has been incorporated for $3.000 to operate electric light plant. The directors are James C. Reed, Pearl Sample, Ida A. Reed.

The Standard Public Service Company has been incorporated to supply light and power to Greenfield Township, Blair County, Penna., with a capital of $5,000. O. H. Hewitt is treasurer.

Charles G. Robin has been incorporated for $10,000 to deal in machinery and electrical instruments. M. and J. Starobin and C. G. Robin of 536 West 113th Street were the incorporators.

The Belleville Ice, Light & Power Company of Belleville, Tex., has been incorporated with a capital stock of $30,000. The incorporators were H. Hamilton, L. A. Machemehl and C. F. Hellmuth.

The Interborough Power Company, Spartanburg, S. C., was chartered with a capital stock of $100,000, the officers being A. M. Law, president; C. R. Willard, vice-president, and R. E. Boggs, secretary and treasurer.

The Motion Picture Electric & Equipment Corporation, Los Angeles, Cal., has been incorporated with a capital stock of $20,000. The directors are H. C. Hickman, Richard Willis, Gus Inglis, Harry D. Brown and Henry W. Otto.

The L. L. Jones Company of Atlantic City, N. J., has been incorporated by Harold L. Boston, Henry R. Lawrence and George A. Bourgeois of Atlantic City. The company is capitalized at $50,000 and proposes to deal in electric and gas fixtures.

The Electric Systems Corporation has been incorporated with a capital of $100,000 to manufacture and deal in machines and mechanisms. The charter was granted to Harry M. Mays, Arthur C. Stone, George Briggs, Jr., and Alton E. Stevens.

The Maxahone Corporation has been granted a charter to manufacture, sell and deal in electrical transmitters, etc. It is capitalized for $1,000,000. The incorporators were E. E. Bishop, M. L. Gatchell and I. M. Bristow, of Wilmington, Del.

The Prudential Light & Power Company, with a capital stock of $50,000, has been incorporated to acquire water power sites on the Mississippi River and sell power to St. Paul factories. The offices of the company are at 407 Germania Life Building, St. Paul, Minn.

The Cortland Electric Company of Brooklyn, N. Y., has been incorporated by F. R. Allen, E. A. Sherry and R. B. Lea, 55 Hanson Place, Brooklyn, N. Y. The company is capitalized at $500,000 and proposes to manufacture and deal in dynamos, electric machinery, measuring, and testing instruments.

Winn & Higgins of Plainfield, N. J., has filed articles of incorporation with a capital stock of $10,000 for the purpose of conducting a general electrical and plumbing business. The incorporators are: Frederick J. Winn, Howard K. Higgins of Plainfield, N. J., and Harry S. Heckheimer of New York, N. Y.

The Ohio Storage Battery Company has been incorporated to take over the business of the Columbus Storage Battery Company, 79 East Spring Street, Columbus, Ohio. The company, which is capitalized at $20,000, will have the following officers: President, G. C. Lee, Jr.; vice-president, J. C. Langley; treasurer, J. A. Weston; superintendent, J. W. Collins.

Trade Publications

Lighting Fixtures.—The Reading Chandelier Works, Reading, Pa., has just issued its catalog No. 16 containing colored designs of lighting fixtures.

Phonograph Motors.—The Arnold Electric Company, Racine, Wis., is sending out a leaflet descriptive of a vertical type motor for operating disk-record talking machines.

Pin-Type Insulators.—The R. Thomas & Sons Company, East Liverpool, Ohio, has prepared a folder which is illustrated and which describes several types of pin-type insulators.

Self-Starting Synchronous Motors.—The Electric Machinery Company, Minneapolis, Minn., has prepared an illustrated leaflet which contains information on a self-starting synchronous motor.

Hot Point Appliances.—The Hot Point Electric Heating Company, Chicago, has issued a Retail Salesmen's Manual giving a description and the selling points of each of the Hot Point lamp-socket appliances.

High Frequency Buzzer.—The Clapp-Eastham Company, 139 Main Street, Cambridge, Mass., is sending out a leaflet which describes and illustrates its high-frequency buzzer for radio work and its fixed capacity condenser.

Ornamental Lighting Fixtures.—The Beardslee Chandelier Manufacturing Company, 216 South Jefferson Street, Chicago, Ill., has prepared sketches G-H-6-1 to G-H-6-6, inclusive, which illustrate various types of its ornamental chandeliers.

Lathes.—The Lodge & Shipley Machine Tool Company, Cincinnati, Ohio, has brought out a loose-leaf catalog which contains illustrations and descriptive matter on the operation of various types of lathes and the uses to which they may be put. The leaves are arranged so that the several parts of the lathes are illustrated and described first, followed by pages dealing with the completed tool.

Recording Instruments. — The Foxboro Company, Foxboro, Mass., has issued several attractively illustrated bulletins which contain information on its recording instruments. Bulletin No. 101 contains descriptive matter on the company's radial planimeter; Bulletin No. 103 on wet and dry bulb recording thermometer; Bulletin No. 95 on indicating gages; Bulletin No. 97 on syphon and mercurial gages of the glass type; Bulletin No. 102 on mechanical and electrical time recorders and Bulletin No. 98 on recording gages for all purposes.

Electric Gear Shift.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has brought out two folders which contain information on its magnetic gear shift for automobiles. One folder is intended for distribution to automobile dealers and contains a list of dealers who sell cars equipped with the magnetic gear shift mechanism, while the second edition is intended for distribution to the automobile public. The folder cover is illustrated with a "close-up" view of Louise Lovely, the motion-picture star, in her motor car, which is equipped with the magnetic gear shift mechanism.

Glass Insulators.—The Hemingray Glass Company, Covington, Ky., has just issued catalog No. 29 which is practically a reissue of its catalog No. 28 with reduced line cuts and is 8 in. by 10 in. in size punched for looseleaf sales books. The catalog lists and illustrates various types of glass insulators.

Die Stocks and Square-End Pipe Cutters. — The Borden Company, Warren, Ohio, has prepared a booklet which is illustrated and which contains information on "Beaver" die stocks and square-end pipe cutters.

Trucks.—Motor Truck Bulletin No. 28 issued by the Packard Motor Car Company, Detroit, Mich., is attractively illustrated and describes the company's worm-drive motor trucks.

New England

PORTLAND, ME.—Permits have been granted to the Cumberland Light & Power Company for conduit rights on Park Avenue and Elm Street, also pole rights on Smith Street.

ENOSBURG FALLS, VT.—Guy Greene, who owns a saw mill in Bakersfield, is installing an electric plant lower down on the same stream to furnish lights for a section of the farmers.

HAVERHILL, MASS.—The Haverhill Electric Company is ready to substitute the new gasfitted lamps for the old arc lamps all over the city. The company is willing to substitute 60-watt incandescent lamps, which will make up the rest of the street lighting system. The new 60-watt lamps would be placed in the outlying sections of the city. The addition of seven lamps to the white way system of the city is under way, and the work of putting the lamps around City Hall Park has begun.

LYNN, MASS.—The Lynn Gas & Electric Company, it is reported, is about to extend a high power line from their station in Montrose to the new Lynn water works pumping station at Middleton.

MILFORD, MASS.—The State Board of Gas and Electric Light Commissioners gave its approval to the issue by the Milford Electric Light & Power Company of additional capital stock amounting to $62,000 for the payment of a floating indebtedness of the company incurred in additions to its plant and distributing system and further proposed additions thereto. It was arranged recently to buy energy from the New England Power Company and the completion of the necessary transmission line and of a transformer station and extensions of its distributing lines during the present season will entail an expense of more than $27,000.

NEW BEDFORD, MASS.—The New Bedford Gas & Edison Light Company is planning to issue 3180 shares of stock at par value of $100. The proceeds of the issue will be used for improvements in the powerhouse and for extensions of the company's distribution system.

NORTHAMPTON, MASS.—The Northampton Electric Lighting Company has awarded a contract to the J. G. White Engineering Corporation, of New York City, for the engineering and construction work involved in the installation of a substation in this city of 5000-kva. capacity, 13,000 volts to 2300 volts alternating current, and the erection of a double-circuit heavy copper transmission line between Northampton and East Hampton.

PITTSFIELD, MASS.—The Pittsfield Electric Company has been given permission by the Board of Selectmen to bring its wires into Lee, provided it uses the Lee Electric Light Company's poles and makes satisfactory arrangements with the Lee company. The Pittsfield company, it is understood, wishes to furnish power to some of the Smith Paper Company's mills.

QUINCY, MASS.—The Bay State Street Railway Company, Boston, Mass., is planning a large extension to its generating station at Quincy Point, which will make the station twice its present size. It is reported that five turbines will be installed of the same capacity as those now operated.

SALEM, MASS.—The Massachusetts Gas and Electric Light Commission has received a petition from the Eastern Massachusetts Electric Company, asking permission to issue 1250 additional shares of stock at $100 a share. The company is planning to erect transmission lines connecting the plants of the Salem Electric Light Company, the Malden & Melrose Gas & Electric Company and the Suburban Gas & Electric Company at Revere.

WORCESTER, MASS.—It is reported that the Worcester Electric Light Company will proceed as soon as possible with the installation of new lamps in Hamilton Street. The work is now being carried up Franklin Street toward Green.

LONSDALE, R. I.—It is planned to install street lamps along Main and Cross streets of the village.

Middle Atlantic

DUNKIRK, N. Y.—At a special election held for the purpose of voting on the proposed restrictive franchise to the Niagara and Erie Power Company, the voters approved the granting of a franchise. It is estimated that the company will spend $250,000 to provide facilities for furnishing electrical energy for power to factories in this vicinity.

NORTH TONAWANDA, N. Y.—When the Common Council meets in regular session on Sept. 5, it is the intention, according to reports, to call for bids for lighting the city which will include a proposition for an improved lighting system for the principal business streets. According to present indications, it is probable that new lamps will be located the entire length of Webster Street and on parts of Main, Tremont, Goundry and Oliver Streets. The contracts with the Tonawanda Power Company for lighting the streets and public buildings expired on Aug. 1, but the contract will continue in force until another has been awarded.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

BEAVER, PA.—R. A. Westfall, head of the municipal department of the Duquesne Light Company, is reported to have said that his company will spend close to $1,000,000 on the Beaver Valley plant within the next few years.

LANSFORD, PA.—Chief Burgess Thomas Gallagher has had an injunction entered against the Panther Valley Electric Light Company, restraining it from erecting a high-tension power line through the town to connect it with the new $45,000 substation at Lansford. The ordinance was passed by the Lansford Town Council over the Burgess' veto, and the citizens of the town have urged Mr. Gallagher to take steps in order to prevent the company from carrying out its wishes.

PHILADELPHIA, PA.—The Ferris Shoe Co. has had plans prepared for extensions and improvements in its power house. Charles E. Oelschlager, architect.

PHILADELPHIA, PA.—John Lang Paper Company has awarded a contract for the erection of a new boiler plant to W. H. Eddleman & Sons, Roxborough, at $20,000.

PHILADELPHIA, PA.—The Pennsylvania Railroad has awarded a contract for the erection of a new power house at the Reed Street freight yard in Philadelphia, Pa., to John N. Gill & Company of Philadelphia, at $20,074.

PHILADELPHIA, PA.—A complete mechanical plant, including electrical work and sprinkler system, will be installed by the E. G. Budd Company in its new automobile manufacturing plant. Ballinger & Perot, architects.

ELMER, N. J.—A committee composed of members of the Chambers of Commerce of Wilmington, Del., Pennsgrove, Woodstown, Elmer, Millville, Vineland and Atlantic City, N. J., is working hard on the project to build either a steam or electric line from Pennsgrove to Atlantic City, connecting all of the other towns interested. It is estimated that a line taking in all of these points would cost $5,000,000. Another plan is to connect only Pensgrove and Elmer with a trolley line, this giving Wilmington and Pennsgrove direct connection with Atlantic City and the other South Jersey points by way of the Pennsylvania and Jersey Central railroads. The two railroads seem willing to cooperate in the project, providing connection is made to their lines.

NEWTON, N. J.—Bids will be received by the Board of Education up to 8 p. m., September 21, for electrical and heating and ventilating work in the public school. Rutherford Tuttle, district clerk.

NEWTOWN, N. J.—The sheriff's sale of the Newton Gas & Electric Light Company's plant, land, etc., occurred at the Court House on Aug. 21. The first and only bid for the property was $30,000 by Albert H. Atteberry of Plainfield, one of the principal bondholders.

WOODSTOWN, N. J.—The electric generating machinery of the Woodstown Ice & Cold Storage Co., the firm which has been supplying this town with electric power for years, has been dismantled and removed by workmen of the International Light, Heat & Power Company, which recently bought out the Woodstown concern. All the current used in Woodstown will hereafter be generated at Bridgeton, a high tension line and substation having been erected for this purpose.

WHEELING, W. VA.—The Pullman Company of Pullman, Ill., will shortly begin the erection at Mingo, O., of a branch plant for the construction of steel cars; 200 acres of land has been purchased for the site at a cost of $200,000.

WILLIAMSON, W. VA.—The plant of the Williamson Light & Ice Company was destroyed by fire, March 15, 1915, and has not been rebuilt except temporarily. The ice plant is now being electrically driven with purchased power, but during the winter the entire plant is to be rebuilt, plans for which are new being drafted. The equipment will probably consist of two turbo-generators, 300 kva. and 400 kva. rating. The exhaust steam is to be used in the ice manufacture. Emmons Graham is manager.

RICHMOND, VA.—An announcement has been made of a proposed extension of the Norfolk & Western electric operations from Vivian, W. Va., westward 10 miles and from Welch up Tug Fork branch for 5 miles.

WASHINGTON, D.C.—Sealed proposals will be opened at the Treasury Department, supervising architect's office, Washington, D.C., at 3 p. m., Sept. 20, 1916, for repairs to heating, plumbing, conduit and wiring, lighting fixtures, etc., in the United States courthouse, etc., at Santa Fe, N. M., in accordance with the drawing and sepecification, copies of which may be had at the office of the Treasury Department, or at the office of the custodian at Santa Fe, N. M., in the discretion of the supervising architect. James A. Wetmore is acting supervising architect.

North Central

ADRIAN, MICH.—The Adrian Casting Company which was destroyed by fire is to be rebuilt as soon as the insurance adjustments have been made. The company was organized in 1904 with capital of $30,000, which was increased in 1914 to $40,000. Amos Kells is general manager and treasurer of the company.

PORT HURON, MICH.—The Detroit Edison Company has purchased 600 acres of land fronting on the St. Clair River, and will erect a substation to supply power for the city and interurban lines of the Detroit United Railway.

ST. CLAIR, MICH.—At a recent session of the Common Council, the recommendation of the board of public works that the city enter into a contract with the Detroit Edison Company for an auxiliary supply of electric power was concurred in, and the contract, it is understood, will be made at once. The St. Clair municipal plant, it is understood, has become inadequate, and the contract with the Detroit company will assure the city a supply when the local plant is not working.

BUCYRUS, OHIO.—The Bucyrus Light & Power Company, it is reported, contemplates the erection of a new power station to be 40 ft. by 52 ft. in area and 36 ft. high. A 400-hp. boiler and generating unit are contemplated. In the spring, it is understood, another 2000-hp. generator will be added. The added cost of the present contemplated improvements, it is understood, is close to $50,000.

CANTON, OHIO.—The Canton Electric Company is now installing at its plant on Second Street, two large boilers for the purpose of enabling the plant to carry increased electrical load through the winter until the big power plant at Windsor, W. Va., is completed. The boilers are 1350 hp. each.

CINCINNATI, OHIO.—Plans for the installation of an ornamental street lighting system covering all streets in the downtown district will be rapidly perfected, as the city and the Union Gas & Electric Company have virtually agreed upon a maintenance price of $60 per light per annum. This question has held up the project for some time. City Electrician Kleine has charge of the matter for the city.

CINCINNATI, OHIO.—A considerable amount of power and electric equipment will be required in the construction of the new building of the Fenwick Club for Catholic Young Men and the Boys' Home, an ice-making plant being in the equipment which will be installed. Theis & Theis of Dayton, Ohio, have designed the structure in all details, and have also been awarded the contract, on their bid of $200,000.

CLEVELAND, O.—W. C. Owen & Co., architects and engineers, Leader News Building, are making plans for a factory building for the new Big Four Tire & Rubber Company. The building is to be 400 ft. long and 80 ft. wide, two stories and basement.

CLEVELAND, OHIO.—C. B. Comstock, architect, 110 West Fortieth Street, New York City, is drawing plans for a baking plant and power house, to be erected in Cleveland for the Ward Baking Company, at an estimated cost of $150,000. Plans will be ready for bids about Sept. 1.

CLEVELAND, O.—The Abbott Corporation of New York has concluded the transaction for the purchase of six acres of land on East 152d Street. The site will cost about $33,000. Contracts have been signed with the Crowell-Lundoff-Little Company for the erection of the factory

building, to cost $150,000 and to be completed November 1. The Abbott Corporation is headed by the Hull Bros. Company of Toledo.

COLUMBUS, OHIO. — The McKeever Electric Company, 244 High Street, Columbus, has secured the contracts for the electrical work on two State Normal Schools, one at Bowling Green and the other at Kent.

DAYTON, O.—Architects Schenk & Williams, 561 Arcade Building, have completed plans and are taking bids for a foundry addition, 40 ft. x 75 ft., for the Computing Scale Company, of which G. W. Kepler is secretary.

LIMA, OHIO.—Improvements to cost in the neighborhood of $75,000 have been started by the Ohio Electric Railroad Company on its local power house. The improvements as planned call for the installation of a 1500-kw. turbine and two 500-hp. boilers. The boilers are to be equipped with superheaters.

LORAIN, OHIO.—The Lorain City Council has passed the franchise ordinance for the electrical facilities of the Citizens Gas & Electric Company, a subsidiary of the Logan Gas & Fuel Company of Pittsburgh. The franchise, which is a twenty-five-year extension of the prersent grant, provides for a maximum electric rate of 7.2 cents per killowatt-hour, a reduction of 28 per cent.

TOLEDO, OHIO.—Architects Starrett & Van Vleck of 18 West Fortieth Street, N. Y. City have completed plans for a large department store, to be erected at the corner of Adams and Huron Streets for the La Sale & Koch Company. The structure will front 180 ft. on Adams Street and 280 ft. on Huron Street and will be eight stories high.

YOUNGSTOWN, O.—Plans have been completed by the G. M. McKelvey Company for large extensions to the present facilities. These involve new buildings on Commerce Street, the razing of the present structure in West Federal Street and the erection of a modern structure in its place; estimated cost, $600,000; work to begin at once.

YOUNGSTOWN, OHIO. — Sealed proposals will be received by the director of public service of the city of Youngstown, Ohio, until 12 o'clock noon, Sept. 8, for furnishing the necessary labor and materials for the design, construction, delivery and erection of one centrifugal air compressor, together with electric motor and all auxiliaries and appurtenances necessary to make the unit complete and ready for service. Plans and specifications may be seen and blank forms for bids at the office of the superintendent of water department. Dan J. Jones is clerk.

INDIANAPOLIS, IND. — Permission to issue $199,000 in capital stock and $945,000 in bonds of an eventual issue of $3,500,000 is asked of the Public Service Commission in a petition filed by the Indiana Power & Water Company. The company proposes to buy the Indiana Water & Power Company of Worthington; the Home Light & Power Company of Bloomfield; the Elnora Light & Power Company; the Meyers Light & Power Company of Odon; the Bicknell Light & Power Company and the Linn Coal Company, also of Bicknell. The petition sets forth that the companies will be connected as a unit to supply light, heat, power and water to the towns and vicinities nearby. Officers who signed the petition are H. L. Clarke, president, and B. E. Simon, secretary, both of Chicago.

RICHMOND, IND.—The City Council has appropriated $2000 for miscellaneous expenses for the municipal electric lighting plant and $7000 for the construction of a water intake from the river to the plant.

CHRISTOPHER, ILL.—The Egyptian Electric Company of Christopher is installing a 2500-kw. turbine with condensing and water-cooling system; also two 500-hp. boilers with super-heaters and water treating plant. Provision will be made for a new ash-handling system. A. W. Spaht is manager.

DECATUR, ILL.—The Central Illinois Electric Company has recently completed 9 miles of 4400-volt transmission line and distribution system for Argenta and Oreana, Ill., and the three-phasing of same. The company now has under construction 7 miles of 4400-volt transmission line and distribution system in Warrensburg, Ill., and about 15 miles of 2200-volt farm lines complete. The company has changed its offices from Buffalo, Ill., to Springfield and Decatur, Ill.

DIXON, ILL.—The Illinois Northern Utilities Company of Dixon is contemplating rebuilding the dam across Rock River at Oregon, Ill.

PAWPAW, ILL.—The Northern Illinois Utilities Company has taken over the Pawpaw lighting plant and this fall, after the erection of a transmission line from Earlville, it is understood, will close the plant and supply Pawpaw with energy from some of the larger sections.

RANTOUL, ILL.—Ways and means are being considered to secure an electric-lighting system here.

READSTOWN, WIS.—The Viola (Wis.) Electric Company has submitted a proposition to furnish electrical energy for light and power to this city.

APPLETON, MINN.—It is reported that Appleton will sell its municipal lighting plant to the Ottertail Power Company of Fergus Falls, as the result of a special city referendum vote. The plant is taken over by the company at $9000.

DULUTH, MINN.—Lines of the Great Northern Power Company probably will be extended from Duluth to Hibbing, to supply light and power to the Mesaba range, according to W. N. Ryerson, general manager of the company in Duluth. A preliminary survey has been completed and the detailed survey to determine the route and cost of the extension will be completed in a very short time. As planned, the line will be about 83 miles in length and will represent an investment of approximately $200,000.

KASSON, MINN.—The village of Kasson is contemplating discarding the municipal electric generating plant and purchasing energy from the Northern States Power Company. E. W. Steinbeck is manager.

MINNEAPOLIS, MINN.—It is reported that Minneapolis and St. Paul are to be connected by the Northern States Power Company, which company will spend in the neighborhood of $500,000. There will be two sets of steel towers, extending 50 miles, each carrying three cables. Power will be brought from Rosetown.

NORTHFIELD, MINN.—The City Council and property owners on Division Street are planning an installation of an ornamental lighting system.

ROCHESTER, MINN.—It is reported that the city is about to construct a $360,000 hydroelectric plant. Hugh L. Cooper will have charge of the work.

ST. PAUL, MINN.—The Prudential Light & Power Company of St. Paul, recently incorporated, proposes to construct a hydroelectric power plant on the Mississippi River to supply energy in St. Paul, specializing in service to the St. Paul Midway factories. The company owns and will acquire power sites on the Mississippi River. The incorporators are: Edward Feldhauser, fiscal agent, St. Paul Southern Electric Railway; Harris Richardson and P. Otis. The headquarters of the company are at 407 Germania Life Building, St. Paul.

WATSON, MINN.—The Village Council is negotiating with the Minnesota Valley Power Company of Montevido to furnish electricity for lamps and motors in Watson.

WOODSTOCK, MINN.—At the next election a vote will be taken to authorize a bond issue for lines, wiring and lamps for the city street lighting systems.

GRINNELL, IOWA.—A new powerhouse costing $100,000, it is understood, will be erected by the Iowa Light, Heat & Power Company.

HARCOURT, IOWA.—There will be an election on September 2 for the authorizing of a bond issue of $3500 for a electric lighting system.

CHILLICOTHE, MO. — The municipal water works and light plant is about to be constructed. Plans and specifications already have been drawn up by E. E. Harper, 2404 East Thirtieth Street, Kansas City, Mo.

EDEN, MO.—The Maine Public Utilities Commission has rendered a decision approving the contract between the Bar Harbor and Union River Power Company and the town of Eden for street lighting service.

EXCELSIOR SPRINGS, MO.—The Excelsior Springs Water, Gas & Electric Company will soon install a 575-kw. General Electric generator direct-connected to a Hamilton-Corliss engine. This firm has recently built transmission lines to small towns in the surrounding territory, and the new equipment was taken on to help take care of the additional load. Cowgill, Mo., is the latest town to be connected with Excelsior Springs by a new transmission line.

KANSAS CITY, MO.—The park board of Kansas City, Mo., will buy soon 175 electric lights of 100 and 250 watts for location in Swope Park, replacing gasoline lamps. Wiring for 100 lamps in the cleared sections will be underground. Wiring for the lights in the uncleared parts of the park will be overhead.

KANSAS CITY, MO.—In the final brief of the Kansas City Light & Power Company in the rate-making case before the Missouri Public Service Commission, the president of the company, John H. Lucas, states that the company must provide for the expenditure of several million dollars for a power plant to meet present requirements and those of several years to come for Kansas City, Mo., and contiguous territory. Plans for the plant are said to be now in course of preparation and a site is being sought, said to be on the Missouri River outside of Kansas City. The company, it is understood, is waiting until this plant is available before prosecuting vigorously its campaign for power contracts.

ST. JOSEPH, MO.—The St. Joseph Railway, Light, Heat & Power Company will install a 5000-kw. turbine before winter. The turbine will be obtained through the General Electric Company.

ST. LOUIS, MO.—The Warren Steel Castings Company has acquired somewhat over 11 acres of land for the erection of a new plant which, it is reported, will be equipped for electric power and all smelting and polishing will be done electrically. To provide this power, the Mississippi Power Transmission Company has installed a high-tension line for 2 miles from its transformer station at Page Avenue and the Wabash tracks.

TROY, MO.—At a special election the voters here decided in favor of the proposition to sell the municipal electric lighting plant and obtain service from the Southern Illinois Light & Power Company.

GRAND FORKS, N. D.—Plans have been announced for improving and enlarging the Grand Forks service of the Tri-State Telephone Company. The company's lines are to be extended through the city and part of East Grand Forks, the plans calling for the erection of 30,000 ft. of new cable. A number of aerials and poles will be removed and much of the cable will be placed underground. The extension of the lines necessitates other improvements in the company's headquarters, such as the installation of new switchboards and other equipment.

KNOX, N. D.—It is understood that Delameter Brothers may install in their local plant a 2200-volt, 5-kw. generator.

PEMBINA, N. D.—A franchise has been granted to H. R. Robowski for the erection and maintenance of a plant, poles, wires and other necessary apparatus for electric light and power service.

LINCOLN, NEB.—The city is accepting bids up to the close of September 12 for a motor-driven centrifugal pump, 500-hp. water-tube boiler and chain-grate stoker, 450-500-hp. Diesel engine, generator and switchboard.

Southern States

SPARTANBURG, S. C. — The South Carolina Light, Power & Railways Company has awarded to the J. G. White Engineering Corporation a contract for the consulting engineering in connection with the design and erection of a concrete dam 600 ft. long and 45 ft. high on the Broad River, near Gaston Shoals, approximately 30 miles from Spartanburg. This dam will be in connection with the company's hydroelectric development at Gaston Shoals.

PLANT CITY, FLA.—The city has granted to Rosco Nettles and associates of Tampa, electric light and gas franchises.

BRISTOL, TENN.—B. L. Dulaney and Fred Dulaney, it is reported, have acquired water rights in the Holston River and have employed engineers to look over the situation and prepare estimates. It is understood that a 1000-hp. plant will be erected at a cost of approximately $75,000.

KNOXVILLE, TENN.—Arc lamps are to be located early in September in many sections of the city not heretofore so lighted, as a result of the city's new contract for street lighting with the Knoxville Railway & Light Company.

GADSDEN, ALA.—It is reported that the Alabama Power Company has men now at work on the construction of a transmission line from Huntsville to Gadsden. The contract, it is understood, will amount to about $1,000,000. Lines will be run to all near-by towns.

ABBEVILLE, LA.—Bids have already been advertised for installing an 80-hp. crude oil engine and a 50-kw. 450-500 volt d.-c. generator, directly connected for the local municipal electric light plant.

NEW ORLEANS, LA.—The Lafaye ordinance providing for the sale of a franchise for city lighting for ten years has been adopted, it is reported, by the Commission Council. The ordinance will be advertised for sixty days, when the franchise will be sold to the highest bidder at public auction.

HENNESSEY, OKLA.—There will be an election on Sept. 15 to grant the Hennessy Electric Light & Power Company a franchise to furnish lighting and power service.

AUSTIN, TEX.—Contract for wiring, lighting, etc., for the new buildings of the Colony for Feeble Minded has been awarded to the Barden Electrical & Machinery Company of Houston, Tex. Contract price, $2,200.

BLANKET, TEX.—Blanket now has electric lights, the current having recently been turned on from the new Brownwood-Comanche transmission line.

DALLAS, TEX.—City commission has let the Westinghouse Electric Company of Texas the annual lamp contract of this city.

DALLAS, TEX.—The Stone-Webster Engineering Corporation of Boston, Mass., has been granted a renewal of its permit to do business in Texas. It has a capital stock of $500,000 and its Texas headquarters are at Dallas.

DALLAS, TEX.—The expenditure of not less than $2,000,000 in Dallas street railway extensions and improvements and lighting equipment; the construction of at least one interurban line into Dallas; a 2-cent reduction in the light rate and estimated expenditures of $5,000,000 in and around Dallas within the next three years, are among the propositions set out in a statement issued by J. F. Strickland and C. W. Hobson as to what the two proposed new utilities companies would do if the city of Dallas should accept the $8,500,000 valuation of the Stone & Webster properties. This is the first announcement of their attitude in the present street railway and lighting controversy since they agreed to become the heads of the new companies. Mr. Strickland has been selected as the head of the new light company and C. W. Hobson of the Southwest General Electric Company of Dallas is to be head of the new street railway company when these local companies are organized.

DENISON, TEX.—Extensive improvements in the lighting system here have been started, comprising East Hickory Street, West Oak Street and ornamental lights around the Courthouse square.

DENTON, TEX.—Plans have been adopted for extending the municipal lighting system.

GEORGE WEST, TEX.—The George West Water and Light Company will construct a water works and electric light plant here at a cost of about $400,000. Charles Schreiner, Jr., of San Antonio is a stockholder.

SAN ANGELO, TEX.—The Interstate Electric Corporation of New York has been granted a franchise by the city commission for the construction of a system of street railroad.

SAN BENITO, TEX.—The San Benito Land & Water Company, it is understood, is contemplating installing a third 50-hp. unit similar to those now in use probably within the next ninety days. At present the company has two 2300-volt, three-phase, 60-cycle generators, with a total rating of 75 kw., and two gas engines with a rating of 100 hp. Ward D. Carpenter is manager.

WACO, TEX.—The Texas Power & Light Company has established a general repair shop at this place. J. D. Shaw has been appointed superintendent.

WACO, TEX.—The City Council has decided to install a police signal system here, replacing the one that has been leased by the city for the past five years. The new system will cost $3,708.60. Address city clerk.

Pacific States

CHEHALIS, WASH.—Mayor J. T. Coleman has recommended to the City Council that standard street lights be installed on the main business streets without unnecessary delay, and the Council is expected to take early action on this suggestion.

HOQUIAM, WASH.—Reported the City Commissioners have under contemplation the plan of purchasing electricity at the switchboard of a concern willing to sell the current at the rate of three quarters of a cent per kilowatt, and then retailing same to municipal customers.

NORTHPORT, Wash.—C. A. Coffin, located at E2512 First Avenue, Spokane, who recently secured a franchise for thirty-five years to supply the town of Northport with light and water, reports he will begin the installation of the power plant and distributing lines early in September. The cost of the work is estimated at about $50,000.

SPOKANE, WASH.—Petition has been filed with the City Council for the installation of an ornamental curb lighting system on Riverside Avenue from Washington to Cedar Street. The Riverside Avenue petition will complete the lighting of Trent, Main, Riverside, Sprague and First Avenues in the downtown business district.

ENTERPRISE, ORE.—Reported preparations for the construction of a new high-voltage transmission line to connect the Joseph plant with other parts of the system of the Enterprise Electric Company of Enterprise, are under way. The work is under the direction of L. M. Simpson, general manager.

MARSHFIELD, ORE.—Charles Hall, manager of the Coos & Curry County Telephone Company, recently reported that work of rebuilding the telephone system between Marshfield and Gold Beach will be started at an early date.

BAKERSFIELD, CAL.—On application of the South Sierra Power Company for a transmission line franchise, the board of supervisors passed a resolution of intention to grant the franchise, and bids will be called for to be received until September 7 and filed in the office of the board.

BRAWLEY, CAL.—At a recent meeting of the City Trustees, a contract was signed with the Holton Power Company, providing for the installation of an adequate system covering the entire city. In connection with the contract, a new pump will be purchased for the city waterworks and electricity used as the motive power.

LOS ANGELES, CAL.—Threats of an injunction suit by the park commission to prevent the Council from forcing it to permit the construction of the proposed power transmission line by the Aqueduct Power Bureau through Griffith Park have been forestalled by the Finance Committee of the Council. Consent was obtained of Colonel Griffith to the building of the line.

MERCED, CAL.—To assure an abundant supply of water from the Merced River, a spot below the Rapids, near Cascade station, has been definitely decided upon as the new location for the $150,000 hydroelectric power plant in Yosemite Park. This plant is to be built by the Federal Government.

RIVERSIDE, CAL.—The Riverside County Gas & Power Company, the Beaumont Gas & Power Company and the Banning Gas & Lighting Company have filed with the California Railroad Commission a joint application for authority for the sale of the property of the Beaumont and Banning companies to the Riverside company for $50,000 of the stock of the Riverside company. It is stated that by the operation of both the Banning and Beaumont companies so combined with a connecting transmission line and the attendant economy of administration, a large field of operation will be afforded and a better profit yielded. It is the intention to tie the three companies together with a transmission system.

SALINAS, CAL.—A. R. Patrick, manager of the Alpine Creamery at Gonzalez, has just returned from inspecting the plant, with a view of making improvements in the near future. Machinery will be overhauled, motors and electric wiring installed. The plant will be operated solely by electricity. W. D. Evans will have charge of the work.

SHASTA SPRINGS, CAL.—The California-Oregon Power Company will soon have completed the survey of the power extension between Shasta Springs and McCloud, a distance of several miles. Material is being distributed along the line for the building of the same. The same company is building an extension from Castella to Carville and Trinity Center, and will have it completed, it is said, within six weeks.

TULARE, CAL.—A proposal to extend the street lighting system in Tulare has been made to the city trustees by Fred. G. Hamilton, superintendent of the western division of the Mount Whitney Power & Electric Company. Under the plan thirty-four lamps would be installed. The matter has been referred to a committee.

BURLEY, IDAHO.—According to reports, a movement has been started to bring electricity into the Raft River valley by Idaho promoters. Power may be brought either from the government lines at Albion, or directly from the Minidoka Dam.

POCATELLO, IDAHO.—The City Council has been petitioned by the Pocatello Municipal League to investigate the question of securing a municipal light and power plant. The resolution introduced by the league asked the city to investigate the purchase of the present power plant and if a deal could not be consummated satisfactorily, the city to install a plant of its own.

TWIN FALLS, IDAHO.—The City Council has entered into a ten-year contract with the Idaho Power Company for the installation of a new street lighting system. It is reported fifty-eight new units will be installed, which will give 50 per cent more light at 5 per cent more cost. Cost of installing the new system will be borne by the Idaho Power Company, and the new system will be installed and ready for operation by Nov. 15, this year.

CALDWELL, UTAH.—The work of rebuilding the lighting system of Caldwell is being rapidly pushed. It is hoped that the improved service will be ready for operation by the middle of September. It is estimated that the Electric Investment Company, which is making the improvements, is spending between $12,000 and $15,000 on the system.

EUREKA, UTAH.—Two new boilers are being installed at the Chief Consolidated Company's mine. It is generally understood that the management of the mine is going ahead with the plans for the electrification of the plant and that the change will be made within a year.

SALT LAKE CITY, UTAH.—Advertisement for bids for the lighting of Salt Lake City with either electricity or gas, or with both, for the three-year period beginning Jan. 1, 1917, has been authorized by the city commission. Bids will be received by the commission until 10 a. m., Sept. 11.

DOUGLAS, ARIZ.—The plant of the Douglas Traction & Light Company, it is understood, is to be enlarged to the extent of about 30 per cent of the present capacity. New machinery will be ordered and installed as soon as possible. R. G. Arthur is manager.

KINGMAN, ARIZ.—George H. Thayer, who is promoting a hydroelectric development on Burro Creek, has been arranging for the acquisition of a franchise from Mohave County for the stringing of power lines into all the towns and mining camps in the county for the distribution of power.

YUMA, ARIZ.—The Title Insurance & Trust Company of Los Angeles, Cal., as trustees, has taken possession of the properties of the Yuma Electric & Water Company and the Yuma Gas Company, and will operate these concerns in the interest of the bondholders. It is said that as a result of the severe flood last spring, the plants are greatly in need of repairs.

BUTTE, MONT.—At a special election recently, the propositions of granting lighting and heating franchises to the Montana Power Company were carried. Heating privilege was given by a majority of thirty-six, while the close margin of seven votes decided the lighting franchise.

BOULDER, COL.—Contracts have been let, it is reported, and preliminary arrangements have been made for the rebuilding and improvement of the Lafayette plant of the Western Light & Power Company, at a cost in excess of $50,000. A cooling pond, 100 x 150 ft. is to be constructed. It will cost approximately $6000.

DENVER, COL.—A new contract between the Denver Gas & Electric Light Company and the city embracing the rates, service and new conditions for city lighting is now under consideration by Mayor Speer and his cabinet. The old contract was made ten years ago by the previous administration and expired last June. Rates, it is understood, are not involved.

CARSON CITY, NEV.—Sixty days have been given the Truckee General Electric Company to remove its poles and wires from the portion of Carson Street to be paved. It is understood that a new line will cost the company in the neighborhood of $6,000.

Canada

LYALL, MAN.—A by-law has been carried authorizing the raising of $8000 for the construction of a light and power plant, and tenders will be called immediately. George Gay, care of Public Utilities Commission, Winnipeg, is engineer.

FREDERICTON, N.B.—The Fredericton Gas Light Company has been granted permission by the Provincial Government to extend its lines over the Fredericton-St. Mary's Highway bridge for the purpose of providing an electric service for the people of St. Mary's and Gibson.

TRURO, N. S.—It is reported that the Town Council has decided to purchase the Chambers electric light plant for the sum of $57,000. Alterations are contemplated, but as yet have not been decided upon.

DUNNVILLE, ONT.—The Town Council will submit a by-law to the ratepayers for authority to borrow $53,000 for the purpose of installing hydroelectric light and power, and to buy out the plant of the existing light company. The town clerk is J. W. Holmes.

EASTNOR TOWNSHIP, ONT.—The Township Council contemplates the installation of a hydroelectric system. The clerk is James Parker, Lion's Head, Ont.

HANOVER, ONT., CAN.—The Light Commission, it is reported, is considering the extensions of the existing light plant, or alter-

native, the construction of a new system. It is understood that estimates will be secured immediately. Dr. Mearns is chainman.

TORONTO, CAN.—Sir Adam Beck, chairman of the Ontario Hydroelectric Commission announced that the commission has decided to spend $1,300,000 at once in duplicating the transmission line with an additional double circuit line from the main switching station at Dundas to Toronto. The Toronto station equipment will be doubled and the Dundas station will also be duplicated. The capacity of the station at Niagara Falls is to be increased to take care of the 50,000 hp. now available, half of which amount is now being supplied. The transmission line is 35 miles in length and is being built to connect Collingwood with the Eugenia Falls-Owen Sound line. The Wasdelle line is also being connected with the Big Chute transmission system.

GLENSIDE, SASK.—Tenders will be received up to September 15, 1916, for the construction of Glenford Rural Telephone Company's extension. Tenders are invited for: (1) The total cost of construction, contractors to supply material and labor; (2) For the cost of construction labor only. All work and material to be according to Government plans and specifications, which may be seen at Department of Telephones, Regina. J. R. Grose, secretary-treasurer, Glenford Rural Telephone Company, Ltd., Glenside, Sask.

Miscellaneous

PANAMA.—Sealed proposals for boiler tubes, electric cable and wire, switch boxes, steel reflectors, electrical shelving will be received at the office of the general purchasing officer, the Panama Canal, Washington, D.C., until 10.30, September 14.

PANAMA CANAL.—Government Proposal. Proposals for electric wire, bell transformers, reflectors, shade holders, electrical attachments, electric switches, push buttons, fuses, circular loom, pliers, drills, rubber tape, soldering paste and asbestos wool will be received at the office of the general purchasing officer, the Panama Canal, until 10.30 a. m., Sept. 18.

1,195,177. MUSICAL INSTRUMENTS; L. G. Bergeron and R. B. Brewer, Lakewood and Cleveland, Ohio. App. filed Aug. 8, 1914. Solenoids for striking chimes.

1,195,178. ELECTRICAL SYSTEM FOR AUTOMOBILES; J. Bijur, New York, N. Y. App. filed Feb. 2, 1911. Parts compactly disposed and easily accessible.

1,195,180. VEHICLE SIGNAL APPARATUS; B. L. Bobroff, Milwaukee, Wis. App. filed Aug. 28, 1915. Arm is projected by solenoids.

1,195,193. SAD IRON; A. Feyes, Pittsburgh, Pa. App. filed May 23, 1914. Handle carries lamp for illuminating the work.

1,195,211. ELECTROLYTIC PROCESS FOR THE EXTRACTION OF COBALT OXIDS; K. S. Guiterman, New York, N. Y. App. filed Aug. 26, 1915. Obtains hydraled oxid of cobalt substantiately pure.

1,195,217. REINFORCED BATTERY-JAR; E. A. Hawthorne and J. H. George, Bridgeport, Conn. App. filed July 3, 1914. Textile reinforcement enclosing the jar.

1,195,232. AUTOMATIC CUT-OUT FOR ELECTRIC MOTORS; H. W. Kimes, Dayton, Ohio. App. filed June 16, 1915. Pressure controlled.

1,195,239. ELECTRICAL-DISPLAY APPARATUS; A. Laszlo, Charlottenburg, Germany. App. filed March 7, 1912. Electrically luminous letters.

1,195,444. SYSTEM OF ELECTRICAL DISTRIBUTION; J. L. Creveling, New York, N. Y. App. filed Oct. 1, 1909. Regular system for charging purposes.

1,195,449. SOLENOID; C. S. Du Belle, Williamsport, Pa. App. filed June 8, 1909. The movement of the core is cushioned at end of stroke.

1,195,355. INDICATING-APPARATUS; C. Gustafson, St. Paul, Minn. App. filed April 23, 1915. Actuated by travel of car.

1,195,472. CUT-OUT SWITCH; A. W. Houchin, Kirkwood, N. J. App. filed June 22, 1914. Magnetism of generator field magnet actuates the catch.

1,195,485. SPACE TELEGRAPHY; C. V. Logwood and C. F. Elwell, Palo Alto, Cal. App. filed June 12, 1911. Signals with continuous waves having frequency higher than audibility.

1,195,499. AUTOMATIC FIRE ALARM; C. B. Rattermann and W. W. Garrison, Birmingham, Ala. App. April 21, 1915. Sends telephonic messages.

1,195,508. COMBINED AMPERE AND VOLT METER; H. A. Schoeller, Frankfort-on-the-Main, Germany. App. filed Dec. 2, 1913. For motor cars and devices subjected to vibration.

1,195,526. POTENTIAL. STARTER; H. A. Steen, Norwood, Ohio. App. filed March 23, 1912. Prevents opening of starter upon low voltage until abnormal condition exist for certain time.

1,195,540. MOTOR CONTROLLER; R. P. Warner, Kalamazoo, Mich. App. filed Sept. 20, 1915. Improved commutator brush contacts; adapted to be carried by end plate of motor frame.

1,195,560. MANUFACTURE OF PEROXID OF HYDROGEN; F. Cobellis, Phila., Pa. App. filed Aug. 23, 1915. Subjects solution of a sulphate salt to heat under pressure and distills.

1,195,574. ELECTRICAL TRANSMITTING DEVICE AND CIRCUITS THEREFOR; J. W. Frost, Washington, D. C. App. filed July 13, 1911. Transmitting an annunciating mechanism for automatic fire-alarm telegraph.

1,195,583. TRAFFIC-DIRECTOR; F. H. Henretta, Roanoke, Va. App. filed May 26, 1916. For directing traffic at street corners.

1,195,589. CALLING DEVICE; W. Kaisling, Chicago, Ill. App. filed Dec. 30, 1911. For two-wire metallic line telephone.

1,195,590. TELEPHONE SWITCH-HOOK; W. Kaisling, Chicago, Ill. App. filed Nov. 1, 1912. Simple, easily adjustable and compact.

Record of Electrical Patents

Notes on United States Patents issued August 22, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.

1,195,592. MANUFACTURE OF WHEEL-RIMS; F. J. Keegan, Coventry, Eng. App. filed April 30, 1913. Turns over edges of flat rim and welds same in place.

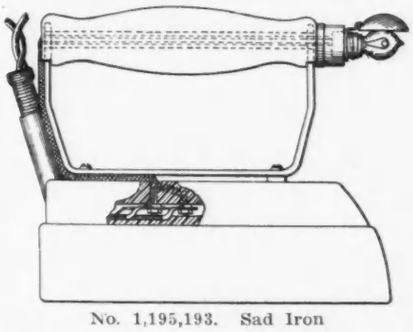
1,195,600. SIGNALING SYSTEM; F. P. McIntosh and E. F. Baubeen, New York, N. Y. and Willmet, Ill. App. filed Nov. 4, 1910. For signaling operator of car to stop.

1,195,601. WATER-HEATER; J. Nathan, Los Angeles, Cal. App. filed Jan. 25, 1915. For hotwater bags, etc.

1,195,607. PROCESS OF SECURING METAL FROM ORES; J. H. Reid, Newark, N. J. App. filed Jan. 13, 1914. Recovery of metal from nickle cobalt silver ore.

1,195,615. ELECTRIC WATER HEATER; M. Simon, St. Louis, Mo. App. filed Dec. 7, 1915. Spreads entering water into a thin sheet.

1,195,616. METHOD OF EXTRACTING METALS FROM THEIR ORES; H. B. Slater, Riverside, Cal. App. filed Sept. 2, 1913. Extraction of copper from ores in which gold and silver are usually low.



No. 1,195,193. Sad Iron

1,195,617. PROCESS OF MAKING A LEACHING SOLUTION FOR EXTRACTION OF METALS FROM THEIR ORES; H. B. Slater, Los Angeles, Cal. App. filed July 28, 1915. Solution containing ferric chloride and sodium chloride together with free cholrin and oxidation products.

1,195,632. CIRCUIT CONNECTION OF ELECTRON DISCHARGE APPARATUS; W. C. White, Schenectady, N. Y. App. filed Aug. 23, 1915. Enables employment of alternating currents for heating the filament.

1,195,639. ENGINE; J. H. Auble, Cincinnati, Ohio. App. filed Nov. 12, 1913. Admits water in the cylinder and then actuates electric heater therein.

1,195,642. AUTOMOBILE SIGNALING DEVICE; I. Bauer, Middletown, Conn. App. filed Oct. 2, 1915. Operated by a set of push buttons.

1,195,660. RHEOSTAT; H. L. Dodge, Iowa City, Ia. App. filed March 15, 1915. For control of current or voltage.

1,195,677. GALVANIC CELL; A. Heil, Frankfort-on-the-Main, Germany. App. filed Dec. 24, 1913. Mixture of black hydrate of maganesa, dioxid, mercuric oxid and caton for depolarizing.

1,195,700. STREET RAILWAY CROSSING; T. C. MacAllister, New York, N. Y. App. filed Aug. 20, 1914. Auxiliary rail and shoe for carrying electric car over crossing.

1,195,704. ELECTROLYTIC PROCESS FOR REMOVING OXID OR RUST; P. Marino, London, Eng. App. filed April 25, 1916. Employs articles as cathodes in aqueous bath containing phosphoric acid.

1,195,712. ELECTRIC MEASURING INSTRUMENTS; C. E. Norton, Manchester, Conn. App. filed March 7, 1913. Magnet and magnet retaining plate construction.

1,195,733. APPARATUS FOR PRODUCING UNDIRECTIONAL ELECTRIC CURRENTS OF HIGH POTENTIAL; F. Rieber, Berkeley, Cal. App. filed Sept. 13, 1915. Exact control and practically noiseless in small space.

1,195,748. BLOCK SYSTEM; R. C. Sutphin, Corydon, Ky. App. filed Aug. 25, 1915. Track with insulated rail sections.

1,195,754. ANNUNCIATOR; W. L. Weber, Chicago, Ill. App. filed Feb. 4, 1915. For "automat" restaurants.

1,195,768. COMBINED REVERSING SWITCH AND BRUSH-HOLDER FOR DYNAMO-ELECTRIC MACHINES; C. Bergmann, Jr., W. New York, N. J. App. filed Oct. 4, 1915. Two sets of contacts associated with brushes and controlled by a double cam.

1,195,771. AUTOMATIC TELEPHONE EXCHANGE SYSTEM; G. A. Betulander and N. G. Palmgren, Sodertorns-Villastad and Stockholm, Sweden. App. filed Dec. 20, 1913. Effects connections by means of relays only.

1,195,778. PANEL-BOARD FITTING; T. W. Byrne and R. C. Lehane, Boston, Mass. App. filed Feb. 9, 1914. Individual covers for built-up panel units.

1,195,790. OIL-FUSE; L. W. Downes and A. W. Faxon, Providence, R. I. App. filed May 27, 1914. Fuse carrier construction.

1,195,813. BRANCH BOX FOR ELECTRIC CONDUCTORS; M. Havens and S. B. Van Ranst, Albany, N. Y., and Syracuse, N. Y. App. filed Jan. 27, 1909. Adapted for the application of a canopy thereto.

1,195,828. ELECTRIC HEATING ELEMENT; L. R. McClathie, Weston, Ont., Can. App. filed March 4, 1916. Grooved porcelain slab supporting heater wire.

1,195,837. VEHICLE-SIGNAL; F. R. Moore, Chicago, Ill. App. filed Sept. 25, 1915. Motor operates swinging arms through ratchet connection.

1,195,861. MANUFACTURE AND CONSTRUCTION OF COMMUTATORS; E. F. Smith, Cincinnati, Ohio. App. filed July 16, 1914. Cuts segments in cylindrical blank, fills in insulating material and then cuts away metal to separate segments.

1,195,891. SEMI-AUTOMATIC TELEPHONE EXCHANGE SYSTEM; W. and R. Aitken, London, Eng. App. filed Dec. 23, 1914. Has an automatic numeral switch.

1,195,900. TRAIN-BULLETIN; S. W. Balch, Montclair, N. J. App. filed Sept. 7, 1912. Can be set from a distant board.

1,195,916. TROLLEY GUIDE; H. J. Dauben, Columbus, and O. L. Stump, Marion, Ohio. App. filed Feb. 10, 1915. Frog having accurate side guiding flanges.

1,195,921. MAGNETO FRAME; W. E. Dow, Braintree, Mass. App. filed Aug. 21, 1913. Single casting serving to hold parts assembled.

1,195,924. SEPARATOR FOR STORAGE BATTERY PLATES; W. S. Gould, New York, N. Y. App. filed March 14, 1914. Has a portion porous electrolyte and another portion inert to electrolyte.

1,195,925. PORTABLE ELECTRIC LIGHTING APPARATUS; H. H. Hirsch, Philadelphia, Pa. App. filed June 19, 1912. Miner's cap construction.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

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AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Semi-annual meeting, New York City, Sept. 28-30.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Pacific Coast Convention, Seattle, Sept. 5-8.

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ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary W. O. Oschmann Oliver Iron & Foundry Co., Pittsburgh, Pa. Annual convention, Chicago, Sept. 18-22.

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COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer T. F. Kennedy, 900 15th St., Denver, Col. Annual Meeting, Glenwood Springs, Sept. 21-23.

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ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Next meeting, Cleveland, Oct. 10-12.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, 34 Ellis St., San Francisco, Cal.

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ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. L. Blumenthal, 179 West Washington St., Chicago, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, C. A. Littlefield, 15th St. and Irving Place, New York. Annual convention, Philadelphia, Sept. 18, 19 and 20.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue Lafayette, Ind. Annual convention, Fort Wayne, Ind., Sept. 12-14.

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IOWA SECTION, N. E. L. A. Secretary, W. H. Thomson, Jr., Des Moines, Iowa.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

JOVIAN ORDER. Jupiter (president), Thomas W. Wynne, Indianapolis, Ind.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo. Annual convention, Indianapolis, Ind., Oct. 18-20.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Mercer, 108 West Eighth Ave., Topeka, Kan.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Temporary secretary, E. A. Wright, Manhattan, Kan.

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MINNESOTA ELECTRICAL ASSOCIATION. Secretary, F. R. Porter, St. Cloud, Minn.

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NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass.

NATIONAL, ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 19th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y. Next meeting, New Orleans, Oct. 10, 1917.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. E. Egan, Room 201, Union Pacific Building, Omaha, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State Street St., Boston, Mass.

NEW ENGLAND SECTION, ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, L. L. Edgar, 39 Boylston St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual meeting, Pittsfield, Oct. 17-20.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST SECTION, N. E. L. A. Secretary, W. G. Letson, Jim Creek Water, Light & Power Company, Arlington, Wash. Annual Convention Seattle, Wash., Sept. 6-9.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

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OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary-treasurer, J. W. Oberender, 502 Dekum Building, Portland, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary, H. M. Stine, 211 Locust Street, Harrisburg, Pa. Annual convention, Eagles Mere, Sept. 5-8.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RAILWAY SIGNAL ASSOCIATION. Secretary-treasurer, C. E. Rosenberg, Times Building, Bethlehem, Pa.

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SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

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SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, Eugene Ashe, Dallas, Tex.

TRI-STATE WATER & LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 Jackson Bldg., Chicago, Ill.

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